FLEXIBLE COMPENSATION AS A RISK SHARING DEVICE
Implications for Industrial Relations and Corporate Finance

by

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ABSTRACT

Recent evidence suggests that the relatively stable industrial relations system that was predominant throughout the post-war period in the United States is undergoing a period of crisis and transformation. One of the most important aspects of that system which has become unsettled is the structure of wage increases: cost of living adjustments and predetermined annual improvement factors based on rules are progressively being abandoned or readjusted while flexible compensation systems seem to have attracted substantial interest. In Italy as well, recent rounds of company level bargaining have been characterized by the increasing diffusion of similar flexible compensation schemes.

Despite their differences, all these kinds of compensation innovations are traditionally seen as incentive devices introduced by firms to increase workers' motivation and productivity. The primary purpose of this thesis is to suggest an additional explanation, largely neglected in the existing literature, for the recent increasing diffusion of a subset of these compensation innovations. More precisely, it will be argued that lump sum bonus systems and profit sharing systems might be introduced as risk sharing devices by firms that perceive more uncertainty about the future or by firms for which the cost of uncertainty has increased. Implications of this hypothesis for industrial relations and corporate finance will be explored.

Thesis supervisors:  Professor Michael J. Piore
                     Professor Robert S. Gibbons
                     Professor Olivier J. Blanchard
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INTRODUCTION

Recent evidence suggests that the relatively stable industrial relations system that was predominant throughout the post-war period in the United States is undergoing a period of crisis and transformation\(^1\). One of the most important aspects of that system which has become unsettled is the structure of wage increases: cost of living adjustments and predetermined annual improvement factors based on rules are progressively being abandoned or readjusted while flexible compensation systems seem to have attracted substantial interest\(^2\).

In Italy as well, recent rounds of company level bargaining have been characterized by the increasing diffusion of similar flexible compensation schemes. This phenomenon has frequently reached the attention of the press and has been the object of the analysis of many commentators. Some among them have claimed that its practical relevance is still limited, both in terms of the number of companies involved and in terms of the fraction of the compensation package that has been actually made flexible\(^3\). Others have, on the contrary, highlighted the recent explosive diffusion of these innovations after a slow beginning\(^4\).

In both countries these innovations include a wide variety of

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\(^1\) For a comprehensive analysis of this evidence, see Kochan, Katz and McKersie (1986).
\(^3\) See, for example, Ponzellini (1987) and De Caprariis (1989).
\(^4\) See, for example, Cossentino, Prosperetti (1989).
compensation schemes that share the common characteristics of making the individual worker's pay flexible and dependent, explicitly or implicitly, on some performance indicator. These schemes, however, differ considerably in the choice of the indicator: systems that are usually loosely classified as "profit sharing" link individual compensation to company-wide budget measures like revenues, operating margins, value added, etc.; the so-called "gain sharing" or "small group incentive systems" are, instead, designed for units within the company and link the compensation of the corresponding workers to technological indicators of collective performance, like output quantity, output quality, savings on materials and tools, etc.; at a lower level within the firm, "individual incentive schemes" tie individual pay to qualitative or quantitative measures of individual performance. Finally, "lump sum bonus systems" consist of payments not explicitly tied to any measure of performance, but likely to be implicitly linked to profitability; these payments are given instead of all or part of a base wage increase and, in the union sector, they are contracted in advance and given at specific dates along the life of the contract.

Unfortunately, the U.S. and the Italian Governments do not systematically keep track of the prevalence of all these systems. Hence, evidence on the diffusion of these innovations has to be inferred from the limited and often unsatisfactory information provided by the available surveys conducted by private organizations. Tables 1, 2 and 3 report results from some of these surveys. The American Productivity Center collected data on a sample of 1,598 organizations representing 10% of the civilian working population of the U.S. in forty different
industry groups in 1986. Table 1 shows that most of the plans surveyed in that year were introduced in the previous five years. Unfortunately, no information is given on the number of flexible systems introduced and terminated before 1986. Without this information the numbers in the table are not enough to claim, as the authors of the survey do, that more new plans have been adopted recently than in the past; nevertheless, the information provided by the table is certainly consistent with such a statement and is also supported by other sources. Particularly striking in Table 1 is the number of surveyed lump sum bonus and gain sharing systems introduced in the 80s as opposed to previous periods.

**TABLE 1: AGE OF FLEXIBLE COMPENSATION SYSTEMS EXISTING IN 1986 IN THE U.S.**

<table>
<thead>
<tr>
<th>COMPENSATION SYSTEM</th>
<th>% of 1986 systems introduced in</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 65</td>
<td>66-70</td>
</tr>
<tr>
<td>Lump Sum Bonuses</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Profit Sharing</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Gain Sharing</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Small Group Incent.</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Individual Incent.</td>
<td>13</td>
<td>12</td>
</tr>
</tbody>
</table>

Note: The last column reports the number of surveyed compensation systems of each type, on which the percentages in the other columns are computed.

---

5. See O'Dell (1986). The sample was made up of members of the American Productivity Center and of the American Compensation Association; one must be cautious in relying on its representativeness.

6. See, for example, BNA (1988).
Table 2 reports results on the prevalence of existing flexible systems taken from the same 1986 survey of the American Productivity Center and from a 1988 survey of the Hay Group based on 688 companies\textsuperscript{7}.

\begin{center}
\begin{tabular}{|l|c|c||c|c|}
\hline
& \% using & \% considering & \% using & \% considering \\
\hline
Lump Sum Bonuses & 30 & 9 & 24 & 14 \\
Profit Sharing & 32 & 6 & 29 & 7 \\
Gain Sharing & 13 & 9 & 10 & 12 \\
Small Group Incent. & 14 & 9 & 18 & 12 \\
Individual Incent. & 28 & 8 & 47 & 13 \\
\hline
\end{tabular}
\end{center}

\textbf{Note:} The percentages in the table are computed on a sample of 1598 organizations for the American Productivity Center Survey and on 688 organizations for the Hay Group Survey.

These surveys show that lump sum bonuses and profit sharing are fairly frequently used compensation systems.

As far as Italy is concerned, there are not data sufficiently informative and representative to allow for a satisfactory empirical evaluation of the dimensions of this phenomenon. Table 3 reports the preliminary results from two incomplete surveys of flexible compensation systems introduced in the most recent contractual round\textsuperscript{8}. As for the

\textsuperscript{7} See Hay (1989). The survey was conducted with the magazine Business Week. Also in this case, one must be cautious in relying on the representativeness of the sample.

\textsuperscript{8} Both these samples contain information only on contracts in which some flexible compensation clause was included; hence, they are not representative of the universe of company level contracts signed in the most recent contractual round. The IRES data were kindly provided by
U.S., systems based on company wide budget indicators and lump sum bonus systems are widely present. These data are particularly striking in the Italian context given that in this country systems based on company wide economic indicators have been only very rarely observed in the more distant past.

**TABLE 3: RELATIVE PREVALENCE OF FLEXIBLE COMPENSATION SYSTEMS IN ITALY**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 of 232 contracts</td>
<td>1 of 60 contracts</td>
</tr>
<tr>
<td>Lumps sum bonuses</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>Profit Sharing</td>
<td>37</td>
<td>27</td>
</tr>
<tr>
<td>Profit Sharing and Gain Sharing</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>Gain sharing</td>
<td>30</td>
<td>38</td>
</tr>
</tbody>
</table>

Note: 17% of the contracts in the IRES survey do not contain any of the compensation systems indicated in the table.

Despite their differences, all these kinds of flexible compensation systems are traditionally seen as incentive devices introduced by firms to increase workers' motivation and productivity. The primary purpose of this thesis is to suggest an additional explanation for the recent increasing diffusion of a subset of these compensation innovations. More precisely, it will be argued that lump sum bonus systems and profit sharing systems might be introduced as risk sharing devices by firms.

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Stefania Cardinaleschi; the NOMISMA data are taken from Cossentino, Prosperetti (1989).

See again, as examples of this approach, O'Dell (1986) and Blinder (1990) for the U.S. and Cossentino, Prosperetti (1989) for Italy.
that perceive more uncertainty about the future or by firms for which the cost of uncertainty has increased.

The figures in the following page help clarify, in a simplified framework, the double nature of incentive devices and risk sharing devices that characterizes flexible compensation systems\(^\text{10}\). Figure (a) gives a highly stylized description of a firm: each circle represents a unit within the firm. In each unit workers are represented by dots. The arrows indicate the existence of various kinds of interactions among workers in each unit and among the different units. The output of these interactions is the value of the firm, before workers' compensation, denoted by \(V\).

The individual effort of each worker and the collective effort of each unit have, in general, a positive effect on \(V\); however, there may be situations in which the opposite is also possible. \(V\) is in fact the outcome of a complicated set of interdependent processes such that an uncoordinated increase in the effort of different workers or different units may have a negative effect on \(V\). Another way to look at the outcome of these processes is that there may be negative externalities between the actions of workers and units: an increase in the action of one element in the firm may force other elements to reduce their action.

\(^{10}\) I owe the idea of using these figures to introduce the issues discussed in this thesis to a M.I.T. Labor Lunch Talk given by George Baker, from Harvard.
Fig. a: THE FIRM

Fig. b: THE COMPENSATION SYSTEMS
and the combined effect on \( V \) may go in either direction.\(^{11}\) In addition, exogenous shocks coming from output and input markets affect \( V \) and make it a random variable\(^{12}\). The owners of the firm are interested in the difference between the value \( V \) and the level of workers' compensation denoted by \( W \).

Figure (b) characterizes the different compensation systems that might be chosen by the owners of the firm. Each compensation system \( W_i \) is characterized by three parameters, \( P_i, \rho_i, \) and \( E_i \):

- \( P_i \) is the performance indicator to which the system \( W_i \) links the compensation level; it can be a technological indicator of individual or collective performance or it can be an economic indicator of aggregate profitability of the firm; technological indicators are assumed to be independent of input and output market shocks, while economic indicators are affected by those shocks in the same way as \( V \);\(^{13}\)

- \( \rho_i \) is the correlation coefficient between the compensation level under system \( i \) and the value of the firm \( V \); since the compensation level

\(^{11}\) For example, at the individual level, a compensation system that rewards individual savings on materials and tools might create situations in which some workers are left idle while waiting for other workers to finish their part of the work with excessive care. At a higher level, over production in one unit might overflow other units reducing aggregate efficiency.

\(^{12}\) Using formal notation, the value of the firm can be specified as \( V = f(e_1, \ldots, e_n) + \epsilon \), where \( f \) is a function of the effort levels \( e_j \) exerted by workers and \( \epsilon \) is a random variable capturing the effects of input and output market shocks.

\(^{13}\) Using the notation of the previous footnote, technological indicators measure subsets of the arguments of the function \( f \) and are independent from \( \epsilon \), while economic indicators are correlated with \( \epsilon \).
is a function of $P_i$, the correlation coefficient $\rho_i$ is higher the higher the correlation between $P_i$ and $V$;

$E_i$ is the capacity of system $i$ to elicit effort in each individual worker; this capacity is measured on a zero to one scale.

In the space $(\rho, E)$ described by Figure (b) a fixed wage system is represented by the origin: it is a system that has no effort elicitation capacity; furthermore, the wage is established before the uncertainty about $V$ is resolved and hence it has no correlation with the actual ex post value of $V$. An individual incentive system is instead characterized by a value of $E$ close to one given the high effort elicitation capacity of this system; the correlation of the implied compensation with $V$ may, however, be low and even negative because of the possibility of undesirable externalities between different workers. For analogous reasons, gain sharing systems as well can imply a negative correlation between the compensation level and $V$, although these systems will in general present less severe problems than those based on individual incentives from this point of view. On the other hand, the effort elicitation capacity of gain sharing systems is probably smaller because of the insurgence of free riding problems. Under a profit sharing system, particularly in large firms, the free riding problem is likely to make the capacity to elicit individual workers' effort very small, but the correlation between the compensation level and $V$ is the highest for two reasons: first, the aggregate nature of budget indicators may induce more coordination between workers and between units within the firm; second, economic indicators are affected in the same direction as $V$ by input and output markets shocks. Hence, in Figure (b), such a
system is situated in a region characterized by high $\rho$ and low $E$. Finally, lump sum bonus systems can be represented as points indicating a zero effort elicitation capacity and a positive correlation between the implied compensation and $V$.

The consideration of different costs and benefits guides the owners of the firm in choosing from among these different systems. A large individual effort elicitation is certainly a desirable property of a compensation system, from the point of view of the firm’s owners; however, high $E$ systems may run into the problems created by the possibility of inefficient interactions between workers and between units. In organizations that are more sensitive to these kind of problems the choice of collective indicators of performance might be preferred in order to induce more coordinated and efficient actions among the components of the organization. In addition, firms that are more subject to large market shocks or firms for which it is more costly not to be able to time the size of workers' compensation according to the fluctuations of profitability might prefer the choice of company wide economic indicators despite their lower effort elicitation capacity. In fact these systems reduce the variance of the difference

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14 The Principal-Agent literature (for example Holmstrom 1982) shows that in the case of team production and uncertain aggregate output, signals of individual agents' effort based on individual output are informative only if the shocks affecting individual output are independent and if there are no externalities between agents' actions. Only in these cases is individual output a sufficient statistic for individual effort. If there is some underlying uncertainty and/or if there are externalities, aggregate output is informative for individual effort and the individual wage should depend on it.
between the firms' value \( V \) and the compensation level \( W \).\(^{15}\)

Compensation systems defined by both a high \( \rho \) and a high \( E \) are the most preferred given the considerations outlined above. However, the characteristics of the available compensation systems seem to imply the existence of an overall downward sloping frontier of feasible \((\rho, E)\) combinations - see again Figure (b). This frontier represents the maximum combinations of \( \rho \) and \( E \) that can be reached, but other considerations might in fact force the firm to choose compensation systems in the area below the frontier. The origin of the axis - i.e. the fixed wage system - is, for example, a very important accumulation point. Historically, for reasons that have not yet been fully clarified by social sciences, the prevalent compensation systems have been those in which individual wages were largely predetermined with respect to shocks affecting the performance of firms or units within the firm.\(^{16}\)

Deviations from a fixed wage system are likely to be halted by the inertia that characterizes industrial relations. In addition, workers risk aversion implies that a risk premium must be paid to workers in

\(^{15}\) Using again the notation of the footnote 12, consider, for example, a compensation system \( W_i = \alpha + \beta f(e_1, \ldots, e_n) \) but independent from \( \epsilon \). Such a system implies that the variance of \( \Pi_i = V - W_i \) is given by \( \text{Var}(\Pi_i) = \text{Var}(\epsilon) \). On the other hand, consider a system \( W_j \) such that the compensation level is linearly correlated with \( V \). Then, \( W_j = a + bV \) and \( \text{Var}(\Pi_j) = (1-b)^2 \text{Var}(\epsilon) \). If \( b \) is less than one this system implies a lower variance of \( \Pi \).

\(^{16}\) Cost of Living Adjustments represent deviations from a theoretical fixed wage system but the variable upon which wages are made dependent is the inflation rate in the economy; also in the presence of COLAs the compensation level remain independent from the performance of the firm.
order to have them accept compensation levels subject to shocks over which they do not have full control.

If a firm decides to abandon the fixed wage system and to move toward systems that are closer to the frontier the gain deriving from this choice must exceed the cost of breaking from tradition and/or the premium to be paid to risk averse workers. The usual interpretation of flexible compensation systems views this gain as the result of the incentive effects generated by paying workers on the basis of performance. This interpretation is claimed to hold also for high $\rho$ - low $E$ systems because, despite their small capacity to elicit individual effort, these systems are good at inducing an efficient coordination of the actions of different workers and different units within the firm. No consideration is given by the traditional view to the possibility that firms, although better than workers at diversifying risk, may yet be interested in solutions aimed at reducing the variance of their payoff. As suggested above high $\rho$ - low $E$ systems, like lump sum bonuses and profit sharing, could be primarily introduced because of their capacity to make compensation levels fluctuate according to profitability. According to this view they would represent for the firm a risk sharing device rather than an incentive device.

The purpose of this thesis is to explore this possibility since it has been largely neglected in the existing literature. No attempt is made at testing the risk sharing interpretation against the incentive interpretation. The empirical work contained in this thesis is limited to showing that some of the implications derived from the consideration of lump sum bonuses and profit sharing as risk sharing devices, are
actually supported by the data.

In the first chapter the basic nature and basic causes of bonus systems are considered. The main findings are that the existence of an uncertain environment increases the probability of signing a bonus contract, and that bonus contracts provide for larger growth in total compensation than straight wage contracts adopted under similar circumstances. These results suggest that bonus systems can best be understood as pay increases on which the firm maintains an option of non-renewal, and for which present workers must be compensated.

The second chapter is instead focused on profit sharing contracts with the aim of describing a specific setting in which uncertainty might affect the firm’s decision to introduce a flexible compensation system. This specific setting involves the joint consideration of two decision processes characterizing a firm: the determination of the desired amount of debt on the financial side and the determination of the compensation package on the labor market side. The main finding is that the introduction of profit sharing systems seems to be accompanied by a larger issuance of new debt, controlling for the level of outstanding debt; furthermore, the level of outstanding debt seems to positively affect the probability of introducing profit sharing. The growing trend of corporate leverage and the evolution of compensation systems have been the major phenomena characterizing financial and labor markets in the 80s. This chapter suggests that some valuable information, for an understanding of what has been observed in these two markets, can be

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17 Written together with Chris Erickson.
offered by the consideration of the interactions between them.

Finally, in the third chapter, attention is shifted to Italy. The absence, at this stage, of good data sources for flexible compensation systems in that country prevents econometric analysis. Starting from the information collected in interviews with economic operators, the chapter is focused on the industrial relation implications of flexible compensation systems. It is argued that gain sharing systems based on technological indicators of performance evolve, in Italy, from historical trends and do not represent a break point in those trends; on the contrary, systems based on company wide indicators do not evolve from the same trends and are instead adopted as risk sharing devices by firms facing more uncertainty about the future. It is further argued that the recent diffusion of profit sharing and lump sum bonus contracts might lead to a break point in Italian industrial relations trends. Far from increasing workers' identification in company goals, as the interpretation based on incentive would suggest, the diffusion of these contracts might create new sources of conflicts within the firms concerning those managerial decisions that affect the riskiness of investment projects. Relevant implications for the future of industrial relations, involving the possibility of an evolution toward workers' participation in managerial decisions, are then open to discussion.
References


De Caprariis, Giulio, "L'economia delle retribuzioni flessibili", Rassegna delle statistiche del lavoro, n.1, genaio-marzo, 1989


Ponzellini, Anna, "La retribuzione per risultati nella contrattazione aziendale", Studi Organizzativi, n.3-4, July-December 1987.
CHAPTER I

LUMP SUM BONUSES IN UNION CONTRACTS:
Semantic change or step toward a new wage determination system

The use of lump sum bonus systems has recently accelerated in a significant fashion. However, despite the growing diffusion, this non-traditional compensation scheme has been relatively neglected in the literature. Technically, lump sum bonuses are payments not explicitly tied to any measure of performance that are given instead of all or part of a base wage increase; in the union sector, these payments are contracted in advance and given at specific dates along the life of the contract. These bonus systems could represent minor, or even just semantic, modifications of the existing methods of wage determination. Or, they may evolve into something radically different from the basic compensation system that dominated the post-war period, with consequent implications for macro- and micro-economic performance. As a first step toward addressing this larger issue, this chapter examines the basic nature and possible causes of bonus systems. Our main findings are that the existence of an uncertain environment increases the probability of signing a bonus contract, and that bonus contracts provide for larger growth in total compensation than straight wage contracts adopted under similar circumstances. This second finding, however, does not necessarily imply that workers are better off in the long-run under the

1 This chapter has been written together with Chris Erickson.
bonus system. These results suggest that bonuses can best be understood as pay increases on which the firm maintains an option of non-renewal, and for which present workers might or might not be compensated.

First, in Section I.1, we present basic information on bonus contracts and on the bargaining units that adopt them. Next, in Section I.2, we suggest several hypotheses about the nature and causes of bonus systems. Finally, in Section I.3, we present econometric evidence designed to distinguish among these hypotheses.

I.1 The characteristics of bonus contracts and their diffusion

The surveys of the American Productivity Center and of the Hay Group that have been described in the introduction provide some information on the diffusion of bonus contracts in the U.S. economy. Both surveys indicate that bonus systems are significant factors in the U.S. economy; note also that they both indicate lump sum bonus systems as one of the innovations more frequently considered by firms for adoption in the future. Unfortunately, to the best of our knowledge, these are the only sources of information for the economy as a whole, since the U.S. government does not systematically keep track of the prevalence of the different compensation systems, and collects virtually no data at all on the non-union sector.

More systematic evidence exists on the union sector. The main finding from here is that lump sum bonus provisions were almost unheard of for non-managerial workers before the 1980s, but have become commonplace recently. The Bureau of National Affairs (BNA) is a private organization which keeps track of all published union contracts for
firms with more than 500 employees; they report that only 6% of the new contracts negotiated in 1984 had lump sum provisions while 19% had these provisions in 1985, 33% in 1986, 32% in 1987, and 36% in 1988.\textsuperscript{2} The Bureau of Labor Statistics (BLS) reports that by the first half of 1989, 42% of all private sector workers under major collective bargaining settlements were covered by lump sum provisions\textsuperscript{3}; before 1982, they did not account for these payments as a separate category because they were so rare. We know of no evidence of any other compensation innovation which has grown so much recently or appears to show such continued growth.

Once again, in the union sector a lump sum bonus is defined as a contracted payment which does not go into the hourly base wage and which is not explicitly tied to individual, group, or company performance; many contracts specify more than one bonus payment over the life of the contract, but the amount and the timing of the bonuses are always specified at signing\textsuperscript{4}. Before discussing hypotheses about the nature and the causes of bonus systems, we will first provide some basic information about their characteristics and about the bargaining units

\textsuperscript{2} See BNA (1988).
\textsuperscript{3} See BLS (1989).
\textsuperscript{4} To give two examples of lump sum provisions from the data set that will be used in the following pages:
- The Zenith Radio Corporation signed a three year agreement with the electrical workers’ union (IBEW) in 12/86, providing for a $750 payment in 12/86 and $700 payments in 12/87 and 12/88.
- The Lockheed Georgia Company signed a three year agreement with the machinists’ union (IAM) in 10/86 providing for a payment in 12/86 equal to 12% of the employee’s earnings during the preceding 12 months and payments in 12/87 and 12/88 equal to 5% of earnings during the preceeding 12 months. (Data from the BLS).
that adopt them: the form bonuses take, their average size, the industries they appear in and their pattern of diffusion. Accordingly, we now turn to our sample of union contracts in large U.S. firms.

This sample consists of 455 manufacturing settlements between 1982 and 1988. The data ultimately comes from the BLS. Information on the size of the average base wage, average wage increase, and sizes and timing of bonuses are included, as well as other characteristics of the bargaining group and the settlement such as the region, industry and union, the number of workers, and whether the contract was preceded by a strike. All 20 of the two-digit manufacturing industries are covered. We choose 1982 as the starting date because this is the first year in which the BLS began to account for lump sum bonuses as a separate category.

66 of the settlements contain bonus provisions; the time pattern of their adoption is presented in Table 1. Note that our sample confirms the finding of the BNA that the adoption of bonus systems has accelerated greatly in the past few years. This trend is even more dramatic when we calculate the percentage of workers in new settlements with bonus provisions. Once again, we conclude that the bonus phenomenon is a recent and widespread innovation.

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5 The original data set is from Vroman and Abcwd (1988), with significant modifications made by Hirtle (1986). The original source of the data was the BLS publication Current Wage Developments. The lump sum information comes from a separate BLS data source. We are grateful to Henry Farber at M.I.T., Wayne Vroman at the Urban Institute and Janice Murphy at the BLS for giving us access to the various parts of the data set.
TABLE 1: Incidence of lump sum provisions in the sample

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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>% OF CONTRACTS WITH LUMP SUM PROVISIONS</td>
<td>0</td>
<td>2.7</td>
<td>11.9</td>
<td>23.2</td>
<td>31.6</td>
<td>34.9</td>
<td>50</td>
</tr>
<tr>
<td>% OF WORKERS IN NEW SETTLEMENTS WITH LUMP SUM PROVISIONS</td>
<td>0</td>
<td>9.7</td>
<td>83.1</td>
<td>40.5</td>
<td>49.8</td>
<td>77.5</td>
<td>58.3</td>
</tr>
<tr>
<td>% OF WORKERS IN NEW SETTLEMENTS WITH LUMPS SUM PROVISIONS EXCLUDING FORD &amp; GM</td>
<td>0</td>
<td>9.7</td>
<td>40.0</td>
<td>40.5</td>
<td>49.8</td>
<td>38.5</td>
<td>58.3</td>
</tr>
</tbody>
</table>

Table 2 presents the basic characteristics of the bonus provisions themselves. We judge two categorizations to be relevant for the hypotheses that will be discussed below: whether the initial bonus is up-front or deferred and whether the bonus comes as a uniform dollar amount for all workers or as a percentage of earnings. The up-front versus deferred distinction is interesting because it suggests why bonuses may be attractive to workers given their discount rates and probability of future turnover or layoff; we define an up-front contract as one in which the first bonus comes within two months of the signing of the contract. The uniform versus percentage distinction is interesting because of the implications for within-firm wage dispersion. Note that while the bonus systems in our sample seem to be evenly split between uniform amount and percentage of earnings, most of the provisions provided for at least the first portion of the bonus payment tend to come up front. Note also that the bonuses were not
insubstantial sums, ranging from $150 to $2120 for uniform bonuses and from 1.5% to 12% of the previous year's earnings for percentage bonuses; the last column gives the average bonus payment per hour of the contract.

**TABLE 2: Characteristics of Bonuses**

<table>
<thead>
<tr>
<th>TYPE OF BONUS</th>
<th># OF CONTRACTS</th>
<th>AVERAGE AMOUNT OF THE BONUS ( $ )</th>
<th>AVERAGE AMOUNT OF THE BONUS ($ / HOUR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UP-FRONT, UNIFORM</td>
<td>28</td>
<td>$1210</td>
<td>$0.21</td>
</tr>
<tr>
<td>DEFERRED, UNIFORM</td>
<td>8</td>
<td>$1080</td>
<td>$0.19</td>
</tr>
<tr>
<td>UP-FRONT, PERCENTAGE</td>
<td>22</td>
<td>$2140</td>
<td>$0.36</td>
</tr>
<tr>
<td>DEFERRED, PERCENTAGE</td>
<td>8</td>
<td>$1300</td>
<td>$0.23</td>
</tr>
</tbody>
</table>

Table 3 presents some summary statistics on the differences between bonus and traditional settlements. The median number of workers is higher for bonus settlements, they are more likely to be preceded by a strike and to contain escalator and profit sharing provisions, and they are more likely to operate at the national level. Table 4 shows the distribution of these settlements across industries. The transportation equipment and petroleum industries seem to have a disproportionate share of these contracts, although at least one such contract has appeared in all but six of the twenty two-digit industries.
### TABLE 3: Characteristics of the settlements in the sample

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>LUMP SUM</th>
<th>NON-LUMP SUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDIAN # OF WORKERS</td>
<td>6,300</td>
<td>2,200</td>
</tr>
<tr>
<td>% OF CONTRACTS PRECEDED BY STRIKE</td>
<td>13.6 %</td>
<td>7.4 %</td>
</tr>
<tr>
<td>% OF CONTRACTS WITH ESCALATORS</td>
<td>59.1 %</td>
<td>44.1 %</td>
</tr>
<tr>
<td>% OF CONTRACTS WITH PROFIT SHARING</td>
<td>15.2 %</td>
<td>4.6 %</td>
</tr>
<tr>
<td>% OF CONTRACTS FROM FIRMS OPERATING AT NATIONAL LEVEL</td>
<td>54.5 %</td>
<td>30.4 %</td>
</tr>
</tbody>
</table>

### TABLE 4: Lump sum settlements by industry

<table>
<thead>
<tr>
<th>INDUSTRY</th>
<th>TOTAL # OF CONTRACTS</th>
<th>% OF LUMP SUM CONTRACTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIC 20: FOOD AND KINDRED PRODUCTS</td>
<td>37</td>
<td>11 %</td>
</tr>
<tr>
<td>SIC 21: TOBACCO PRODUCTS</td>
<td>5</td>
<td>20 %</td>
</tr>
<tr>
<td>SIC 22: TEXTILE MILL PRODUCTS</td>
<td>37</td>
<td>0 %</td>
</tr>
<tr>
<td>SIC 23: APPAREL AND OTHER TEXTILE PRODUCTS</td>
<td>26</td>
<td>0 %</td>
</tr>
<tr>
<td>SIC 24: LUMBER AND WOOD PRODUCTS</td>
<td>18</td>
<td>0 %</td>
</tr>
<tr>
<td>SIC 25: FURNITURE AND FIXTURES</td>
<td>8</td>
<td>13 %</td>
</tr>
<tr>
<td>SIC 26: PAPER AND ALLIED PRODUCTS</td>
<td>38</td>
<td>21 %</td>
</tr>
<tr>
<td>SIC 27: PRINTING AND PUBLISHING</td>
<td>11</td>
<td>0 %</td>
</tr>
<tr>
<td>SIC 28: CHEMICALS AND ALLIED PRODUCTS</td>
<td>33</td>
<td>3 %</td>
</tr>
<tr>
<td>SIC 29: PETROLEUM AND COAL PRODUCTS</td>
<td>12</td>
<td>33 %</td>
</tr>
<tr>
<td>SIC 30: RUBBER AND MISC. PLASTICS PRODUCTS</td>
<td>14</td>
<td>7 %</td>
</tr>
<tr>
<td>SIC 31: LEATHER AND LEATHER PRODUCTS</td>
<td>8</td>
<td>0 %</td>
</tr>
<tr>
<td>SIC 32: STONE, CLAY, AND GLASS PRODUCTS</td>
<td>20</td>
<td>10 %</td>
</tr>
<tr>
<td>SIC 33: PRIMARY METAL INDUSTRIES</td>
<td>28</td>
<td>4 %</td>
</tr>
<tr>
<td>SIC 34: FABRICATED METAL PRODUCTS</td>
<td>19</td>
<td>21 %</td>
</tr>
<tr>
<td>SIC 35: MACHINERY, EXCEPT ELECTRICAL</td>
<td>25</td>
<td>12 %</td>
</tr>
<tr>
<td>SIC 36: ELECTRIC AND ELECTRONIC EQUIPMENT</td>
<td>43</td>
<td>23 %</td>
</tr>
<tr>
<td>SIC 37: TRANSPORTATION EQUIPMENT</td>
<td>44</td>
<td>55 %</td>
</tr>
<tr>
<td>SIC 38: INSTRUMENTS AND RELATED PRODUCTS</td>
<td>9</td>
<td>22 %</td>
</tr>
<tr>
<td>SIC 39: MISC. MANUFACTURING INDUSTRIES</td>
<td>9</td>
<td>0 %</td>
</tr>
</tbody>
</table>
I.2 Hypotheses about the nature and causes of bonus systems

A reading of the industrial relations environment reveals two apparent facts: management tends to view bonus systems as tools to lower labor costs, and unions generally oppose them. In a separate report from the one mentioned above, the Hay Group describes bonuses as follows: "Lump sum payments in lieu of base wage increases are a tactic that first gained reluctant acceptance in collective bargaining agreements, in industries where all parties recognized the need to become more competitive. Effectively, base wages are frozen but employees still have periodic lump sum payments to look forward to."\(^6\) Interviews with personnel managers have confirmed this view - that bonus systems are perceived as serving to bring base wages into line with some lower standard. On the union side, the Teamsters for a Democratic Union comment in their newsletter that "Lump sum bonuses are part of a management strategy to eventually pay non-union wages in a union shop. The lump sum bonus ... is not really a bonus at all - it's a delayed wage increase that does not add to the sum of our base wage. It's a lousy wage increase because it doesn't accrue and build our base wage as an hourly increase does."\(^7\) Interviews with union leaders have indicated that bonuses are generally opposed in principle as concessionary. These considerations suggest as a first approximation that bonuses are just a one-shot tactic to avoid raising wages.

Yet, there is also another side of the story. In the just

\(^7\) See Braxton (1989).
mentioned report, the Hay Group goes on to state that "With each subsequent year, the relief [for the company] becomes cumulatively greater, and the possibility of larger lump sum awards grows"\textsuperscript{8} (emphasis added); this suggests that bonuses may not be perceived by firms as one-shot tactics and could in fact persist and become a significant portion of pay. On the union side, interviews with people in the labor movement have indicated that the rank-and-file, particularly younger workers, do not necessarily oppose bonus systems to the extent the leadership does. Furthermore, some of the less dogmatic union leaders, while opposing bonuses in principle, appreciate that there may be circumstances under which they are appropriate, and many view explicit profit sharing much more favorably. For example, one union leader told us that he was willing to accept that some pay should come in the form of a bonus when the company does not know whether or not its product market environment will allow it to pay the same wages in the future. In addition, it is not clear that the bonus itself (the form of payment) is opposed so much as its perceived tendency to accompany cuts in growth in total compensation (the size of the total settlement). These observations suggest that the lump sum bonus phenomenon might not be transitory after all, and opens up a range of questions about the basic nature of these systems and the conditions under which they are adopted.

Unfortunately, it is too early to answer definitively the most interesting question: are bonus systems only temporary tactics which will be replaced by the old system of automatic base wage increases once

\textsuperscript{8} See Hay Group (1987).
the real base rate has been sufficiently reduced, or will they evolve into something else like explicit incentive or profit sharing systems? It does seem difficult to believe that they can continue in their present form indefinitely, given the near across-the-board opposition of the unions to these systems. We also cannot yet say with confidence whether bonuses are more easily taken away than wage increases, although we can say that this seems to be the perception of the parties involved. What we can do is to describe possible scenarios which define the basic nature of bonuses and the conditions under which they may be likely to appear and present empirical evidence which provides clues as to which of the scenarios best approximates reality.

SCENARIO 1: The bonus system is in fact identical to the wage system and bonuses are nothing more than a semantic change, with no effects on payoffs in the bargaining process.

This scenario is based on the assumption that a dollar is a dollar and it does not matter what form the payment takes. Rational agents should be able to see through any difference in the form of payment, and a union with given bargaining power should be able to extract the same amount from the firm regardless of whether it comes in the form of wage increases or bonuses. This implies that the amount of money that each worker gets under a bonus contract must be exactly equal to the present discounted value, over the life of the contract, of what he/she would have gotten under the wage system. This explanation also requires that bonuses are no more easily taken away than wage increases and that unions can just as easily demand a compounded growth in the bonus as in
the wage. The empirically testable implication of this scenario is that, within each contract, after controlling for the characteristics of the bargaining unit, the compensation package under the bonus system should be identical to the compensation package under the wage system; we cannot yet adequately test for whether the bonus is more easily taken away in the next contract, however.

This scenario is clearly unsatisfactory. First of all, it does not give us any hint about why a merely semantic change should be favored by the firm, given that labor costs would be the same under both systems if this were the true explanation. Even more, it does not explain why these systems should be becoming so prevalent in U.S union contracts, as we have shown above. Finally, this explanation does not tell us why unions should oppose bonuses so strongly.

**SCENARIO 2:** Bonus systems are worth less than wage systems adopted under similar circumstances, even within the life of a single contract.

This scenario implies that firms face lower labor costs under bonus systems within each contract. It requires the assumption that workers either do not perceive this cut in wages or have higher discount rates than the firm. To give an example of the first possibility, a personnel manager told us that the workers in his plant accepted a bonus system because they did not understand that three yearly wage increases will compound, while three bonus payments will not. Along the same lines, workers may not perceive the amount of money that they lose due to the fact that bonuses do not go into the base on which overtime and some benefits (such as pensions) are calculated; hence, a package which might
seem like a fair deal to the worker might in fact represent a cost savings to the firm.\textsuperscript{9} As for the discount rate argument, the firm may save on labor costs within each contract by exploiting the preferences of workers for large sums of money immediately rather than wage increases spread over time which add up to more money when discounted at the market rate of interest. The empirically testable implication of this scenario is that, within each contract, after controlling for the characteristics of the bargaining unit, the compensation package under the bonus system should be worth less than the compensation package under the wage system.

This scenario does have its merits. It gives a satisfactory explanation for why firms should favor bonus systems, and is consistent with some anecdotal evidence: bonuses do tend to be loaded up front, and union leaders have told us that it is difficult to generate a strike against a new compensation system which promises a big check upon signing. However, on the firm side it does not explain why bonus systems have only appeared recently. On the union side, if the compounding or benefits story is true, why do the unions fail to inform their workers of these effects before ratification; if the discount story is true, why do union leaders oppose these systems if they meet the preferences of the rank and file?\textsuperscript{10} Note that the two types of motivation for this explanation give different predictions about the

\textsuperscript{9} The same argument is presented on the union side in Braxton (1989).

\textsuperscript{10} It is true that several unions, notably the IAM, are engaging in "education campaigns" to inform their members of the advantages of wage increases over bonuses.
permanence of bonus systems: if compounding is the issue, then one would expect that workers will eventually see the trick and bonus systems will disappear; while if discount rates or forced savings are at work, then in some sense a fair trade is occurring and bonus systems could persist.

SCENARIO 3: Bonuses can be cut in future contracts much more easily than wages; hence, firms must pay for this "option of non-renewal"

This scenario requires an institutional or psychological reason to explain why it is more difficult to cut nominal wages than to fail to renew a bonus in future contracts. Anecdotal and scholarly evidence suggests that this is in fact the case.11 Taking this for granted, a bonus system can be designed so as to provide the same present discounted value of lifetime earnings as a wage system adopted under similar circumstances. This implies that, in order to compensate workers for the higher probability that the bonus will be taken away in the future, the firm must pay more money over the life of a bonus

11 Webster's New Collegiate Dictionary (1973) defines "bonus" as: (1) something given in addition to what is usually or strictly due, (2) money or an equivalent given in addition to an employee's usual compensation.

Kahneman, Knetsch and Thaler (1986) report the following results from a telephone survey of 198 Canadians in 1984-85: when people where posed the following question: "A small company employs several people. The workers' incomes have been about average for the community. In the recent months, business for the company has not increased as it has before. The owners reduce the workers' wages by 10% for the next year", the responses were: acceptable 39%, unfair 61%. However, when a separate group was asked: "A small company employs several people. The workers have been receiving a 10% annual bonus each year and their total incomes have been about average for the community. in recent months, business for the company has not increased as it had before. The owners eliminate the workers' bonus for the year", the response were: acceptable 80%, unfair 20%.
contract than over the life of a wage contract adopted under similar circumstances. The empirically testable implication of this scenario is that, within each contract, after controlling for the characteristics of the bargaining unit, the compensation package under the bonus system should be worth more than the compensation package under the wage system.

There are several possible reasons why the firm, the workers, or the union might favor or oppose a bonus contract which pays more than the alternative straight wage contract in the present contract but less in expected value terms in future contracts. We now examine three such explanations.

Scenario 3a: The adoption of the bonus contract is related to uncertainty about future performance of the firm.

This modification of the basic "option" scenario is based on the assumption that the bonus is more easily taken away than a wage increase when the firm is facing a downturn, so that an increase in the perceived probability of the occurrence of bad states should make the bonus system more desirable to the firm. If we further assume that the firm's labor demand is elastic with respect to wages, not only the firm but also the workers could benefit from this increase in wage flexibility: models of the labor market such as the one presented in Weitzman(1984) indicate that a decrease in employment induced by a shock to demand or to non-labor costs could be neutralized by wage flexibility. In short,

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12 This explanation begins to blur the distinction between bonus systems and explicit profit sharing; perhaps bonus systems just allow
the gain induced by the shift to a bonus system could be positive sum for both the workers and the firm.

If, on the other hand, we assume that union wage determination simply involves the division of ample and exogenously determined rents so that the firm’s employment decision is unrelated to the wage, any gain to the firm from increased wage flexibility should represent an equal loss to the union. Yet, it is still possible that uncertainty matters if the firm has more complete information than the union about the future performance of the company or the firm interprets the commonly available information differently. Under this type of assumption, suppose that a firm perceives for the future an environment that is more uncertain than the one faced in the past; in other words, suppose that it becomes increasingly more difficult to forecast the size of the pie to be split with the workers in the future. If this perception is not shared by the union, the firm should find it advantageous to shift to a bonus system that would fully compensate workers if uncertainty were at the lower level perceived by the union, but in fact increases the profits expected by the firm on the basis of its different perception about future variability of performance. Again, the key assumption of this scenario is that there is a range of "bad states" over which the firm can exercise the option of non-renewal on a bonus but cannot cut the base wage in future contracts.

The empirically testable implications of this scenario are twofold:

workers to trade off wage stability for employment stability in the long-run (i.e. over the course of the next contract) while profit sharing provides this trade off in the shorter-run.
first, the probability of signing lump sum bonus contracts should be increasing with some measure of uncertainty about the future performance of the firm. In addition, as with the more general option scenario, within each contract, after controlling for the characteristics of the bargaining unit, the compensation package under the bonus system should be worth more than the compensation package under the wage system. Clearly, however, it is impossible to determine empirically if the larger within-contract compensation package under the bonus system fully compensates workers for the uncertainty concerning future contracts perceived by the firm.

This scenario, compared to those described above, seems to have one substantial merit: not only does it explain why firms may favor bonuses systems, but it also gives some clue about the reasons for the increasing prevalence of these innovations in the eighties. It has been argued by Piore and Sabel (1984), among others, that the postwar period up to the seventies was a period of relative stability for the U.S. economy, and that this stable environment allowed for the viability of the more rigid compensation system described above (based on fixed annual improvement factors and cost of living adjustments), while at the same time the compensation system was in itself a part of the regulatory mechanism that helped to maintain the stability of the environment. The late seventies and the eighties have been periods of greater uncertainty for U.S. companies. Yet, a different kind of uncertainty is at play now than in the late seventies. Before Reagan and in the aftermath of the oil shocks, the issue was uncertainty about prices, and in general nominal variables such as interest rates, due to the inflationary
environment. In the eighties, the various attempts to deregulate the economy and to reduce the presence of the state in the market, the sky-rocketing federal deficit, and the increasing foreign penetration in U.S. markets have all created different sources of uncertainty. In particular, it can be argued that U.S. companies have encountered situations in which elements such as these have affected their market shares in not easily predictable ways. Those specific situations, which are likely to have affected different companies in different periods, may have caused the perception of increasing uncertainty hypothesized here. However, this scenario is still unsatisfactory for one key reason: it does not explain the strong opposition of unions to bonuses. According to the assumptions above, the firm is in fact able to design a bonus system that fully compensates workers given their perception of the future. Yet, unions tend to oppose bonuses in principle. The following scenario addresses this issue of union opposition.

Scenario 3b: The firm exploits the fact that yet-to-be hired workers will not receive the bonus if it is not renewed, while workers with high expected quit rate favor the bonus system because they expect to leave.

Starting from the basic option value story outlined in scenario 3, here we assume that the existing work force has a shorter time horizon than the firm and the union, which both take into account workers who will be hired in the future. Under these circumstances, the firm may find it profitable to propose a bonus system that fully compensates the existing work force but leaves the expected base wage lower than under the equivalent wage system. The higher profit to the firm would be due
to the fact that such a bonus system would amount to a subtle way of introducing a two-tier wage system in which workers hired in the future, when the bonus is not paid, would essentially receive a lower compensation package than the one received by older workers. The latter would have received in the past the compensation that they do not get in the future, while newly hired workers would simply be paid less. Note that, in contrast to explicit two-tier systems, at any given moment in time new workers earn the same wage as older workers, perhaps leading to a less disruptive work environment.\footnote{The Hay Group (1987) points out another sense in which lump sum payments may reduce the disruptive environment created by a two-tier wage system. They note that "the lump sum tactic is usually the smoothest way to integrate [an explicit] two tier wage structure. Under this approach, new employees are hired at lower rates than existing employees are receiving for the same positions. In most cases, the senior employees are effectively frozen at the old rates (or put into lump sum programs), while the gap between the new and the old tiers is gradually closed."}

In addition, note that not all existing workers will gain equally from the shift to a bonus system. If young and low tenure workers perceive a higher probability of quitting or being laid off because of greater turnover at the beginning of their careers and because of seniority rules, they will put more value on money guaranteed in the present contract against money promised in future contracts. Furthermore, when the bonus comes in the form of a uniform dollar amount for all of the workforce as often seems to be the case\footnote{See Table 2.}, low tenure workers receive a proportionally higher compensation increase because they start from a lower base wage. Finally, young workers are less
likely to participate in some benefits related to the base wage such as pensions and medical payments. On the other hand, older workers who expect to retire soon also have low expected tenure and so might also favor money in the present contract over money promised in the future when they will be gone. Given these differences in the way workers regard bonuses, in addition to playing off present employees against future employees, the firm might use bonus systems to cut its costs by benefiting only part of the present workforce at the expense of the others.

In short, the firm can cut its costs either by making present workers better off at the expense of yet-to-be-hired workers or by splitting the present workforce. However, unless we assume the existence of a fixed cost of changing systems, perhaps in the form of worker dissatisfaction with the concept of change, bonuses would always be a dominant strategy for the firm and at least part of the workforce. Given that we do not observe bonuses everywhere, these fixed costs are likely to be at play and so some other condition must be met for the appearance of bonuses. One such condition could be an increase in uncertainty about the firm's performance: if fixed costs exist, when uncertainty increases the value of the innovation to the firm increases, raising the likelihood that those fixed costs will be overcome. One would also expect that bonus systems would have a higher value to firms that are expanding, and thus are likely to soon reap the benefits of the implicit two-tier system upon hiring new workers.  

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15 The existence of queues for union jobs, which generally pay much
The empirically testable implications of this scenario are fourfold: first, as in scenario 3a, uncertainty should positively affect the probability of signing bonus contracts. Secondly, a proxy for an expansionary firm environment, indicating the likelihood of hiring in the near future, should also positively affect the probability of signing bonus contracts. Thirdly, firms with more young and high expected quit rate workers should be more likely to adopt these innovations. Finally, as in the other variants of the option value story, the bonus contract should provide more money within the life of the agreement than wage contracts signed under similar circumstances.

This scenario gives an explanation for why some workers might accept bonus contracts while unions oppose them: union leaders are likely to care about those workers who will be hired in the future and will bear the cost of the innovation in the event that the firm exercises the option of non-renewal. In addition, this scenario shares the same merits as the previous one, 3a, as far as relying on uncertainty to explain the recent increasing prevalence of bonuses. On the other hand, it seems unlikely that firms would slight workers who

higher wages than similar non union jobs, probably rules out the possibility that the jobs would go unfilled at a slightly lower rate of compensation. For an analysis of queues for union jobs, see Farber (1983). Of course, if the wage is used as a recruitment device to find more qualified workers, this issue becomes more complicated.

16 This may be motivated by a higher sense of solidarity and participation in the cause on the part of union leaders, or, in a more greedy and rational world, it could be due to the fact that union leaders have to get reelected in the future. By making their opposition to bonuses clear, they gain the right credentials to represent newly hired workers in the future.
expect to stay with the company a long time and yet-to-be-hired workers at the expense of those present workers who expect to leave, as long as there is some perceived relationship between wages and the quality of the workforce\textsuperscript{17}: the gain from cutting labor costs in this way may well be overwhelmed by the losses due to the effect on morale and effort of part of the present and future workforce. Finally, this explanation is based either on expectations of an expansionary environment or on uncertainty independent from the level of present and expected future performance, while anecdotal evidence suggests that the parties involved tend to associate these systems with situations of firm or industry crisis when concessions are imposed on workers.

\textbf{Scenario 3c: In a situation in which the union is forced to take concessions and the fixed costs of shifting away from tradition have to be paid anyway, a bonus system may be preferred by workers to a concessionary wage contract.}

As we said at the end of the description of the previous scenario 3b, the story based on the firm and existing workers gaining from bonus systems at the expense of yet-to-be-hired workers does not tell us why these systems might be more likely to appear in a concessionary environment. Suppose, however, that the fixed cost of change comes more from an aversion to change in-and-of itself rather than to shifting away from one ideal type of system to a different one. Under this assumption, if the firm is hit by shocks that make the old base wage dynamic

\textsuperscript{17} E.G. efficiency wage theories and wages as a recruitment device to find qualified workers.
incompatible with expected performance, independent from uncertainty, the bargaining unit will incur the fixed cost anyway because a lower than customary wage growth is imposed by the situation. Hence, for a given level of uncertainty, bonus systems should be more likely to be adopted in a concessionary environment because the fixed cost of shifting away from the traditional system is less relevant. Note that despite the fact that some present workers might prefer the bonus system, union leaders on behalf of future workers would still likely oppose bonuses for the same reasons outlined in the scenario 3b. In this case, future workers hired after the firm exercises the option of non-renewal would essentially take a larger concession than the one taken by present workers when the bonus system is introduced. Yet, if many current workers are either indifferent or prefer the bonus system once it is agreed that concessions have to be taken, union leaders may not be able to gain enough support from the rank and file to fight the innovation.

Empirically, this scenario is distinguishable from the previous one because now, for any given level of uncertainty, a proxy for the existence of a concessionary environment rather than an expansionary environment should positively affect the probability of signing bonus contracts. In addition, as with the above scenario 3b, firms with young and low tenure workers and firms that face high uncertainty should be

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18 Suppose, for example, that the workers have always received "3% plus COLA", which is one stylization of the post war regime. If the company can no longer give a 3% and remain viable, is it much more of a change to also alter the form of payment?
more likely to adopt these innovations. Finally, as in all the variants of the option value story, the bonus contract should provide more money, within the life of the agreement, than wage contracts signed under similar circumstances.

The scenarios outlined above have different empirical implications that allow us in principle to distinguish among them in the data. These implications are summarized in Table 5. However, at this stage of our research, we do not yet have all of the empirical information needed to adequately evaluate these differences; furthermore, given the very recent appearance of bonus systems, any attempt to estimate their permanence in the future or their possible evolution is seriously compromised. However, the use of econometric techniques with our data set allows us to get hints about which of these scenarios is most accurate. More generally, we are able to address the following two fundamental questions:

(1) Do bonus agreements provide to workers more, less, or the same amount of money as traditional contracts adopted under similar circumstances?

(2) Under what types of circumstances are bonus systems adopted?
<table>
<thead>
<tr>
<th>Scenario</th>
<th>Determinants of the probability of signing a lump sum contract</th>
<th>Determinants of compensation growth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Proxy for uncertain future</td>
<td>Proxy for high quit rate</td>
</tr>
<tr>
<td>Scenario 1: Bonuses are a semantic modification</td>
<td>no effect</td>
<td>no effect</td>
</tr>
<tr>
<td>Scenario 2: Bonuses are worth less (discounting, ignorance, forced saving)</td>
<td>no effect</td>
<td>no effect</td>
</tr>
<tr>
<td>Scenario 3: Bonuses include the option of non renewal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) uncertain future raises the value of flexibility</td>
<td>raises probability of bonuses</td>
<td>no effect</td>
</tr>
<tr>
<td>b) firm and present workers gain at the expense of future workers</td>
<td>raises probability of bonuses</td>
<td>raises probability of bonuses</td>
</tr>
<tr>
<td>c) fixed costs of changing compensation system are more easily overcome in a concessionary environment</td>
<td>raises probability of bonuses</td>
<td>raises probability of bonuses</td>
</tr>
</tbody>
</table>
1.3 Empirical results

1.3.1 DO BONUS AGREEMENTS PROVIDE TO WORKERS MORE, LESS OR THE SAME AMOUNT OF MONEY AS TRADITIONAL CONTRACTS ADOPTED UNDER SIMILAR CIRCUMSTANCES?

The purpose of this section is to attempt to distinguish among the three basic scenarios by determining how much money workers get under bonus contracts compared to wage contracts adopted under similar circumstances. Our testing procedure allows us to reject the hypothesis that workers are paid less. Hence, we conclude that the adoption of a bonus system is most likely not just a short-run tactic to cut labor costs within the present contract, but rather a more sophisticated arrangement such that any cost savings for the firm can only result from failing to renew the bonus in subsequent agreements.

Starting from sample comparisons, Table 6 presents the wage characteristics of the settlements. On average, non-lump sum contracts provide for a 3.7% annual growth in wages, including COLA provisions, over the life of the contract, while lump sum contracts provide for a 2.6% annual growth in wages.\(^{19}\) The average bonus increase is 0.7%, so

\(^{19}\) For Table 6 and the wage regressions which follow, total COLA payments for incomplete contracts were calculated by projecting the realized COLA at the point the data was collected until the end of the contract using the DRI inflation forecast at the time of writing, assuming that the same relationship between the rate of inflation and the size of the COLA payment would hold from the time of data collection until the end of the contract as from the time of signing until the date of data collection. This might introduce a bias to the extent that COLAs are front-loaded and caps on COLA payments are present. Recall from Table 3 that lump-sum contracts are more likely to contain COLA provisions; it is also true in the sample that lump sum contracts are less likely to be capped (5% of the lump sum contracts have caps while 18% of the non-lump sum contracts have them).
that the average growth in total compensation is lower in bonus contracts. This finding should not, however, be taken at face value: it does not address the more interesting question of whether a bonus contract gives more or less money than a wage contract adopted by a similar company in a similar environment in a particular year; i.e. it does not isolate the effect of the bonus from other factors at work in the economy, in particular industries or in particular companies. We can hold these factors constant by using econometric techniques.

TABLE 6: Wage characteristics of the settlements in the sample

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>LUMP SUM</th>
<th>NON-LUMP SUM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$/hour ($1983)</td>
<td>% of signing pay per year</td>
</tr>
<tr>
<td>AVERAGE HOU RLY PAY AT SIGNING*</td>
<td>11.04 (1.63)</td>
<td>1.3</td>
</tr>
<tr>
<td>AVERAGE WAGE INCREASE</td>
<td>0.38 (0.38)</td>
<td>0.65 (0.83)</td>
</tr>
<tr>
<td>AVERAGE COLA INCREASE</td>
<td>0.46 (0.51)</td>
<td>0.20 (0.35)</td>
</tr>
<tr>
<td>AVERAGE COLA PLUS WAGE INCREASE</td>
<td>0.84 (0.54)</td>
<td>0.85 (0.88)</td>
</tr>
<tr>
<td>AVERAGE BONUS INCREASE</td>
<td>0.24 (0.18)</td>
<td>0.85 (0.88)</td>
</tr>
<tr>
<td>AVERAGE INCREASE IN TOTAL COMPENSATION</td>
<td>1.08 (0.59)</td>
<td>3.3</td>
</tr>
</tbody>
</table>

* The average hourly pay at signing includes bonuses in previous contract.

Note: standard deviations in parentheses

Accordingly, we propose the following procedure to test the three basic scenarios presented above. Let \( \Delta w \) be the annual growth rate of
nominal take-home pay (wages and bonuses) over the life of the contract.\textsuperscript{20} Let LS be a dummy variable equal to one if the contract contains a lump sum bonus provision, zero otherwise. Let FR be the fraction of total compensation accounted for by the bonus. Consider the following regressions:

(1) \[ \Delta w = x\beta_1 + \alpha_1 LS + \epsilon_1 \]

(2) \[ \Delta w = x\beta_2 + \alpha_2 FR + \epsilon_2 \]

where \( x \) is a matrix of industry, region, and year dummies, as well as a constant and other labor market, institutional, and expectational variables which might influence the size of collective bargaining settlements.

The above three scenarios about the nature of bonuses correspond to the following hypotheses on \( \alpha_1 \) or \( \alpha_2 \):

- Scenario I: \( \alpha_1 = 0 \)
- Scenario II: \( \alpha_1 < 0 \)
- Scenario III: \( \alpha_1 > 0 \)

Note, however, that \( \Delta w \) is not the ideal dependent variable. It has been suggested that one of the principal differences between bonuses and wage increases is that the latter go into the base on which overtime and

\textsuperscript{20} First, calculate the average hourly value of the bonus over the life of the contract, as presented in the last column of Table 2. Then let \( w_1 \) be the nominal value or hourly compensation, wages plus bonus, at the end of the previous contract, \( w_2 \) the nominal value of hourly compensation at the end of the present contract, and \( q \) the length of the present contract in years. Then, \( \Delta w = 100*(\ln(w_2) - \ln(w_1))/q. \)
benefits are calculated while bonuses do not.\footnote{21} In order to evaluate whether bonus contracts pay more or less than wage contracts, we want to take into account these other components of the entire compensation package. Hence, we constructed another dependent variable as follows. We found the portion of total labor costs accounted for by pensions, insurance benefits, payment for time not worked, meals, etc. from the U.S. Chamber of Commerce by two-digit industry and the maximum average number of weekly overtime hours by two-digit industry for the period 1970-1983 from Employment and Earnings; using this information we inflated the wage portion of the compensation increase, leaving the bonus portion unchanged.

The variable that we thus obtained, \( \Delta TC \), is a proxy for the growth of total labor cost incurred by the firm, or, looking at it from the other side, a proxy for the growth of the total compensation package received by the workers. Yet, it is still not precisely the measure we would like to have because it exaggerates on average the advantage to the worker of a dollar in the base wage against a dollar in the form of the bonus within the life of the present contract. This bias is due to the following reasons. First, it is difficult to determine whether all the benefits we included are a function of the size of the hourly wage, particularly insurance benefits. Furthermore, the assumptions about the extent of overtime that we are forced to make for the lack of better data are quite extreme. Finally, this measure does not take into account the time pattern of payments: we noted above that most bonus

\footnote{See, for example, Braxton(1989).}
clauses provide for at least part of the bonus payment to come at the beginning of the contract, so bonuses are probably worth more in present discounted value terms than similar increases in the base wage over the life of the contract.\textsuperscript{22} Unfortunately, it is not possible to adequately compare the present discounted value of two contracts with different lengths without making a restrictive assumption about the size of compensation following the contract; in fact, this is exactly the type of assumption we want to avoid, since we do not want to attempt to estimate the workers' beliefs about the probability of the bonus being terminated.

In short, we believe that $\Delta TC$, although for our purposes a better measure than $\Delta w$, is still unsatisfactory because on average, within the life of a contract, the growth of traditional wage system compensation packages is overestimated against the growth of lump sum bonus compensation packages. The existence of this bias suggests that the correct way to frame our testing procedure is as a one-tail test in which the null hypothesis is that bonus contracts pay less or the same amount of money as wage contracts adopted under similar circumstances. If, despite the fact that $\Delta TC$ overestimates the growth of compensation in wage contracts, we can still reject the null hypothesis that bonus contracts provide less or the same amount of money, we will be able to conclude with confidence that, on average, firms that introduce bonuses do not succeed in cutting compensation within the life of the present

\textsuperscript{22} E.G. if the contract is one year long, a $365$ lump sum payment upon signing is worth more to the worker than $\$1$ per day over the life of the contract.
contract. More formally, if despite this bias the hypothesis \( H_0: \alpha_1 \leq 0 \) can be rejected in the equations

\[
\begin{align*}
(3) \quad \Delta T C &= \beta_3 + \alpha_3 LS + \epsilon_3 \\
(4) \quad \Delta T C &= \beta_4 + \alpha_4 FR + \epsilon_4
\end{align*}
\]

we can consider this as convincing evidence consistent with the "bonus as revocable option" story presented in Scenario III above.\(^{23}\)

The matrix \( x \) of regressors include industry, region, and year fixed effect dummies as well as the unemployment rate at the time of settlement, the expected inflation rate at the time of settlement as determined from a regression of the CPI on two annual lags over the period 1950-1988, the inflation surprise over the life of the contract if positive for contracts with COLA provisions, the inflation surprise over the previous contract, the change in the firm's labor force over the previous contract, and dummies for whether the bargaining unit generally sets or follows a regional or intra-industry wage bargaining

\(^{23}\) Recognizing that the value of the contract (in terms of growth rate of compensation) and the existence of a bonus provision are simultaneous outcome of the same contract negotiation process, instrumental variable techniques are in principle required to estimate the equations (1), (2), (3) and (4) in the text. We instrument for LS and FR as follows. Consider a Logit regression on the probability of signing a lump sum contract (such Logits will be presented below); let \( P \) be the predicted probability from that regression. If at least one explanatory variable in the Logit regression can be assumed not to be an explanatory variable in the wage growth regression, we can use \( P \) as an instrument for LS. To get an instrument for FR, we regress FR on the same explanatory variables in the Logit regression for the values of FR > 0. We then use the coefficients from this regression to find the predicted value of FR for all observations. Defining these predicted values as PREDFR, the following is a valid instrument for FR: \( P*PREDFR \) if PREDFR > 0, 0 otherwise.
pattern. When we use LS alone as an indicator for the bonus contract, we test only for whether shifting to the bonus system has an effect on the constant; using FR allows us to see whether the size of the bonus, not only its existence, has any effects. In order to determine whether either of these possibilities is clearly predominant, we also ran two specifications, one for each of the two dependent variables, in which we include both LS and FR.

Moving on to our results, Tables 7 and 8 present the estimates from the growth rate regressions described above. Whether the presence of a

---

24 Because our primary concern here is to determine whether bonus contracts are worth more or less than non-lump sum contracts, we will not attempt to provide detailed arguments for the inclusion of these variables in the wage equations; these are typical explanatory variables in union wage equations such as those presented in Vroman, Abowd (1988) and Kochan (1988). In brief:
- the unemployment rate proxies for the tightness of the labor market and should be negatively correlated to the growth of nominal wages;
- expected inflation should have a positive effect on the nominal settlement to the extent that the union and the firm bargain over expected real wages;
- the inflation surprise over the life of the contract should increase the size of the nominal settlement for those contracts with COLAs, more for uncapped than for capped COLAs;
- the inflation surprise over the previous contract should increase the settlement to the extent that there is compensation for real losses in the previous contract;
- the change in the firm's labor force proxies for how well the firm is doing and should be positively correlated with the size of the settlement;
- the existence of wage patterns should increase the size of the settlement to the extent that they allow unions to "take wages out of competition"; these variables were constructed by Thomas Kochan and are described in Kochan (1988).

25 We instrumented for LS and FR as described in footnote 23; the identifying variables are dummies for whether or not another company in the same region or industry had signed a lump sum contract in the past. We report both Ordinary Least Square (OLS) and Instrumental Variable (IV) results; we ran specification tests in which we rejected the hypothesis that OLS is correctly specified in most cases. We do not
lump sum provision raises or lowers, ceteris paribus, the value of total compensation within the life of the contract is indicated by the sign of the coefficients on LS and FR. Looking at the first four columns of Table 7, in which the dependent variable is ΔW, the coefficients of interest are positive and it is possible to statistically reject that they are negative or zero with a margin of error (p value) not larger than 5% for OLS, 1% for IV. 26 In the fifth and sixth columns the two coefficients are still positive, but statistically not significantly different from zero; this shows that the effect of the size of bonuses versus the effect of the existence of bonuses independently from size cannot be adequately distinguished in our data. We conclude that bonus contracts do not provide less money than pure wage contracts adopted under similar circumstances when only the straight compensation package, excluding overtime and benefits, is considered.

---

26 The margin of error is 1% for IV when the null is zero and it is lower if the null is less than zero.
TABLE 7: Determinants of the magnitude of the average annual growth rate of nominal wages*

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>OLS</th>
<th>IV</th>
<th>OLS</th>
<th>IV</th>
<th>OLS</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- .320</td>
<td>-2.062</td>
<td>.113</td>
<td>-1.001</td>
<td>- .217</td>
<td>-1.483</td>
</tr>
<tr>
<td>constant</td>
<td>(.11)</td>
<td>(.68)</td>
<td>(.04)</td>
<td>(.34)</td>
<td>(.07)</td>
<td>(.48)</td>
</tr>
<tr>
<td></td>
<td>.076</td>
<td>.136</td>
<td>.029</td>
<td>.016</td>
<td>.062</td>
<td>.060</td>
</tr>
<tr>
<td>unemployment rate in month of settlement</td>
<td>(.23)</td>
<td>(.39)</td>
<td>(.09)</td>
<td>(.05)</td>
<td>(.18)</td>
<td>(.17)</td>
</tr>
<tr>
<td></td>
<td>.500</td>
<td>.555</td>
<td>.460</td>
<td>.457</td>
<td>.488</td>
<td>.492</td>
</tr>
<tr>
<td>expected inflation at time of settlement</td>
<td>(1.70)</td>
<td>(1.84)</td>
<td>(1.56)</td>
<td>(1.52)</td>
<td>(1.65)</td>
<td>(1.60)</td>
</tr>
<tr>
<td>inflation surprise over the life of the contract, if positive</td>
<td>1.067</td>
<td>1.031</td>
<td>.911</td>
<td>.608</td>
<td>1.001</td>
<td>.718</td>
</tr>
<tr>
<td>- uncapped colas</td>
<td>(2.66)</td>
<td>(2.51)</td>
<td>(2.19)</td>
<td>(1.34)</td>
<td>(2.33)</td>
<td>(1.44)</td>
</tr>
<tr>
<td>- capped colas</td>
<td>(3.83)</td>
<td>3.973</td>
<td>3.514</td>
<td>3.166</td>
<td>3.714</td>
<td>3.404</td>
</tr>
<tr>
<td>inflation surprise over previous contract</td>
<td>(.45)</td>
<td>(.46)</td>
<td>(.41)</td>
<td>(.37)</td>
<td>(.44)</td>
<td>(.38)</td>
</tr>
<tr>
<td>growth of workforce</td>
<td>(.76)</td>
<td>(.73)</td>
<td>(.84)</td>
<td>(.94)</td>
<td>(.79)</td>
<td>(.87)</td>
</tr>
<tr>
<td>regional pattern dummy</td>
<td>7.76</td>
<td>7.52</td>
<td>7.73</td>
<td>7.50</td>
<td>7.74</td>
<td>7.47</td>
</tr>
<tr>
<td>industry pattern dummy</td>
<td>.308</td>
<td>.235</td>
<td>.298</td>
<td>.198</td>
<td>.298</td>
<td>.193</td>
</tr>
<tr>
<td>LS: lump sum dummy</td>
<td>(1.48)</td>
<td>(.36)</td>
<td>(.46)</td>
<td>(.30)</td>
<td>(.46)</td>
<td>(.28)</td>
</tr>
<tr>
<td>FR: bonus as a fraction of total compensation</td>
<td>1.054</td>
<td>.853</td>
<td>1.055</td>
<td>.847</td>
<td>1.037</td>
<td>.801</td>
</tr>
<tr>
<td>N</td>
<td>335</td>
<td>330</td>
<td>335</td>
<td>330</td>
<td>335</td>
<td>330</td>
</tr>
<tr>
<td>R squared</td>
<td>.42</td>
<td>.40</td>
<td>.42</td>
<td>.40</td>
<td>.42</td>
<td>.40</td>
</tr>
</tbody>
</table>

* Including bonuses but not fringes.

Note: t-statistics are shown in parentheses; the regressions include industry, region, and year fixed effects dummies.
TABLE 8: Determinants of the magnitude of the average annual growth rate of total compensation

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>OLS</th>
<th>IV</th>
<th>OLS</th>
<th>IV</th>
<th>OLS</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>constant</td>
<td>- .064</td>
<td>-2.547</td>
<td>.388</td>
<td>-1.628</td>
<td>- .118</td>
<td>-1.950</td>
</tr>
<tr>
<td></td>
<td>(.02)</td>
<td>(.82)</td>
<td>(.13)</td>
<td>(.53)</td>
<td>(.04)</td>
<td>(.61)</td>
</tr>
<tr>
<td>unemployment rate in month of settlement</td>
<td>.121</td>
<td>.187</td>
<td>.078</td>
<td>.080</td>
<td>.129</td>
<td>.109</td>
</tr>
<tr>
<td></td>
<td>(.34)</td>
<td>(.52)</td>
<td>(.22)</td>
<td>(.22)</td>
<td>(.36)</td>
<td>(.30)</td>
</tr>
<tr>
<td>expected inflation at time of settlement</td>
<td>.719</td>
<td>.795</td>
<td>.682</td>
<td>.707</td>
<td>.726</td>
<td>.731</td>
</tr>
<tr>
<td></td>
<td>(2.35)</td>
<td>(2.54)</td>
<td>(2.22)</td>
<td>(2.25)</td>
<td>(2.35)</td>
<td>(2.28)</td>
</tr>
<tr>
<td>inflation surprise over the life of the contract, if positive</td>
<td>.743</td>
<td>.716</td>
<td>.641</td>
<td>.320</td>
<td>.778</td>
<td>.394</td>
</tr>
<tr>
<td>- uncapped colas</td>
<td>(1.78)</td>
<td>(1.69)</td>
<td>(1.48)</td>
<td>(.68)</td>
<td>(1.74)</td>
<td>(.76)</td>
</tr>
<tr>
<td></td>
<td>.937</td>
<td>4.198</td>
<td>3.695</td>
<td>3.453</td>
<td>4.000</td>
<td>3.612</td>
</tr>
<tr>
<td></td>
<td>(.45)</td>
<td>(.47)</td>
<td>(.42)</td>
<td>(.38)</td>
<td>(.45)</td>
<td>(.40)</td>
</tr>
<tr>
<td>inflation surprise over previous contract</td>
<td>.174</td>
<td>.172</td>
<td>.168</td>
<td>.148</td>
<td>.176</td>
<td>.153</td>
</tr>
<tr>
<td></td>
<td>(1.37)</td>
<td>(1.33)</td>
<td>(1.31)</td>
<td>(1.13)</td>
<td>(1.38)</td>
<td>(1.16)</td>
</tr>
<tr>
<td>growth of workforce</td>
<td>.048</td>
<td>.049</td>
<td>.048</td>
<td>.050</td>
<td>.048</td>
<td>.049</td>
</tr>
<tr>
<td></td>
<td>(4.99)</td>
<td>(4.97)</td>
<td>(4.97)</td>
<td>(4.91)</td>
<td>(4.99)</td>
<td>(4.90)</td>
</tr>
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<td>.386</td>
<td>.463</td>
<td>.346</td>
<td>.463</td>
<td>.343</td>
</tr>
<tr>
<td></td>
<td>(.69)</td>
<td>(.57)</td>
<td>(.69)</td>
<td>(.50)</td>
<td>(.69)</td>
<td>(.50)</td>
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<td>industry pattern dummy</td>
<td>.505</td>
<td>.328</td>
<td>.541</td>
<td>.306</td>
<td>.514</td>
<td>.275</td>
</tr>
<tr>
<td></td>
<td>(.96)</td>
<td>(.59)</td>
<td>(1.03)</td>
<td>(.55)</td>
<td>(.98)</td>
<td>(.49)</td>
</tr>
<tr>
<td>LS: lump sum dummy</td>
<td>.840</td>
<td>2.026</td>
<td>.972</td>
<td>.616</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.65)</td>
<td>(2.06)</td>
<td>(1.25)</td>
<td>(.40)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FR: bonus as a fraction of total compensation</td>
<td>.222</td>
<td>.806</td>
<td>-.070</td>
<td>.645</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.09)</td>
<td>(2.15)</td>
<td>(2.22)</td>
<td>(1.10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>335</td>
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<td>335</td>
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</tr>
<tr>
<td>R squared</td>
<td>.33</td>
<td>.32</td>
<td>.33</td>
<td>.31</td>
<td>.33</td>
<td>.31</td>
</tr>
</tbody>
</table>

* The dependent variable weights wage increases (but not bonuses) by the industry average proportion of payroll accounted for by overtime and fringe benefits, excluding legally required payments.
Note: t-statistics are shown in parentheses; the regressions include industry, region, and year fixed effects dummies.
When total cost growth $\Delta TC$ is considered (Table 8), the coefficients on LS and FR are still positive, but the upper bounds on the margins of error at which we can statistically reject the hypothesis that they are zero or negative increase to 5% and 14%, respectively, for OLS and 2% for IV. We still consider this as evidence in favor of Scenario 3, although we can say this with less confidence than in the case of the wage growth equations discussed above. However, in evaluating these results, recall that $\Delta TC$ is biased against rejecting the hypothesis that bonus contracts provide less money and this may well contribute to the larger margins of error. Furthermore, additional evidence against the idea that workers are fooled (one of the variants of Scenario 2) is that ten out of fourteen contracts in our sample that follow bonus settlements continue with these provisions; if workers had been unaware of the implications of bonuses regarding overtime and benefits, one would probably expect learning to have occurred.

We want to emphasize that the finding that bonus contracts do not provide less than wage contracts adopted under similar circumstances does not mean that bonus contracts are never concessionary. What the result does say is that a bonus contract adopted in a concessionary environment will not provide less than a wage contract adopted in the same concessionary environment, although both will be concessionary compared to past contracts. Anecdotal evidence also supports the view that bonus contracts provide more than wage contracts adopted under similar circumstances: in the negotiations with GM that led to the split of UAW-Canada from UAW-USA, the U.S. autoworkers accepted a lump sum contract, but the Canadians held out for an increase in the base wage.
GM essentially told the Canadians that they could have an increase in the base wage, but that they would have to accept less money overall than they would have gotten if they had taken it in the form of bonuses.27

We also want to emphasize that our findings do not necessarily imply that workers are better off under the bonus system. Our findings are consistent with the possibility that they receive less in long-run expected value than under the wage system; i.e. they may not be fully compensated for the option of non-renewal.

In conclusion, our econometric results suggest that bonus contracts do not provide less money than wage contracts adopted under similar circumstances. This finding leads us to speculate that when the unions say that they get less money with lump sum bonus contracts, they are probably not comparing their settlements to what they would have gotten under similar circumstances if there had been no bonus. Rather, they must be comparing the present contract to the past when they perhaps got more, or they are thinking about future contracts when the bonus might be taken away more easily than a wage increase.

I.3.2 UNDER WHAT TYPES OF CIRCUMSTANCES ARE BONUS CONTRACTS ADOPTED?

The second question we seek to address is: in what situations are lump sum provisions more likely to be adopted? Some of the scenarios presented above and interview evidence suggest that an increase in the uncertainty about the company's future as well as the existence of a

27 This anecdote is taken from the documentary Final Offer.
concessionary or expansionary environment in the present should have a positive effect on the probability of adoption. We can also test for the importance of other characteristics of the bargaining unit, such as the size of the base wage at the end of the previous contract relative to the rest of the industry, and characteristics of the industry, such as the existence of lump sum provisions in other firms. We can best address these questions with a logit regression on the probability of signing a lump sum contract.

In order to test for the importance of firm-specific effects, we merged the contract data set used so far in the analysis with firm-level data from COMPUSTAT and CRSP and industry-level data from the Current Population Survey (CPS). We used the COMPUSTAT and CRSP data to get proxies for uncertainty and expansionary or concessionary environments as follows. For uncertainty, we regressed the ratio of sales to total assets against a constant and a time trend for the five years preceding the signing of the contract. We then created two variables that we call "positive variability" and "negative variability". Positive variability is the deviation of sales/assets from trend in the year before the contract, divided by the sum of the absolute deviations in the five years before the contract, if this deviation is positive; the variable is zero otherwise. Negative variability is the same variable for a negative deviation in the year before the contract is signed.  

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28 COMPUSTAT is a computerized data bank containing legally required balance sheet and income data for publicly traded companies; CRSP contains data on stock prices.

29 More formally the two variability measures are derived from the
Separating these trend deviations into positive and negative shocks allows us to determine whether the reaction to these two types of uncertainty (positive and negative) is symmetric. We also created a "stock market uncertainty" variable which is the variance of excess returns on the firm's stock in the year before the settlement divided by the variance over the two years before that. We believe that these variables capture the essence of "uncertainty" in that they do not just measure the value of the deviation from trend or stock price variability in the year before the contract, but the extent to which the recent past has been more uncertain than the more distant past. In other words, when the value of these variables increase, firms are less able to say with much confidence whether they are moving along the same trend line they perceived in the past or along a different one; to put it still another way, these variables are designed to capture the concept of a change in environment which cannot be easily identified as an outlier in the old distribution of events rather than a movement to a new distribution.

To capture whether the firm is more likely to be in an expansionary

\[
\frac{\left(\frac{S}{a}\right)_{t-1} - \text{trend}_{t-1}}{\sum \left|\left(\frac{S}{a}\right)_{t-1} - \text{trend}_{t-1}\right|}
\]

where \( S \) = sales, \( a \) = total assets and trend = predicted value from a linear trend regression for sales/assets. The variable called "positive variability" is equal to this ratio if positive and zero otherwise; the variable "negative variability" is equal to the absolute value of this ratio if negative and zero otherwise.
or in a concessionary environment, we define two other variables. "positive performance" is defined as the coefficient on time in the above trend regressions if positive, zero otherwise; "negative performance" is the absolute value of the same variable for negative coefficients.

Another type of variable we include in our regressions is the ratio of the base wage at the end of the previous contract to the average industry wage, as measured in the CPS. Some might want to define concessions as actions designed to bring unusually high wages back into line with the firm's competitors. If so, we should expect to see bonuses where wages are high relative to the rest of the industry and thus "concessions" are most appropriate.

We also include two "imitation dummies", one for the four-digit industry and one for the detailed geographic region (two digit). The industry imitation dummy is equal to one if at least one other firm in the same industry has signed a lump sum contract one month or more before the contract in question; the geographic imitation dummy is defined similarly. We expect these variables to be important to the extent that pattern bargaining occurs within industries or regions, or, alternatively, to the extent that firms in the same industry or geographical region share the same labor market and so tend to follow the same compensation policies.

---

30 As for the imitative pattern of the adoption of bonus systems, the following is true in our sample:
- 29 of the 66 lump sum contracts came at least one month after another contract with lump sum provisions was signed in the same four-digit industry.
In addition, we include the median age of workers in the industry, as measured in the CPS. As mentioned above, scenario 3b suggests that young workers might favor bonuses more than older workers. This variable is also included to get at the issue of expected tenure, albeit in a very rough manner, since there are good reasons to expect that both very young and very old workers will have low expected tenure. The number of workers in the bargaining unit is also included because it is possible that large firms systematically employ different compensation policies. Finally, we include a constant and industry, region, and year dummies.

Tables 9 and 10 present the results of logit regressions on the probability that a bargaining unit signs a lump sum contract. The dependent variable is equal to one if the contract contains a lump sum provision, zero otherwise. Table 9 presents the actual coefficients from the regressions, while Table 10 presents the marginal effects of the variables on the probability of signing a lump sum contract.

---

46 of the 66 lump sum contracts came at least one month after another contract with lump sum provisions was signed in the same detailed geographic area.

Note that the magnitude of the coefficients in Table 9 have no direct economic interpretation because these are the true coefficients divided by the standard error of the regression. On the contrary, the numbers reported in Table 10 are more easily interpretable in that they represent the increase in the probability of observing bonuses from changing the variables by the amounts defined in the footnote to that table. As for statistical significance, the t-statistics in Table 9 are more reliable indicators of the influence of the variables on the probability of signing a lump sum contract than are the t-statistics reported in Table 10.
<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>industry region</th>
<th>industry region</th>
<th>industry region</th>
<th>industry region</th>
<th>industry region</th>
</tr>
</thead>
<tbody>
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<td>-60.720</td>
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<td>(2.65)</td>
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<td>-.251</td>
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<td>(.28)</td>
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<td>(1.12)</td>
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<td>(1.76)</td>
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<td>(1.81)</td>
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<td>45</td>
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<td>46</td>
<td>45</td>
</tr>
<tr>
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<td>–16.18</td>
<td>–42.08</td>
<td>–15.96</td>
<td>–12.51</td>
</tr>
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</table>

a The variance of excess returns on the company’s stock over the year before the contract divided by the variance over the two previous years.

b See footnote 29

c The coefficient on five year trend of sales/assets if positive, zero otherwise.

d The absolute value of the coefficient on five year trend of sales/assets if negative, zero otherwise.

Note: t-statistics are shown in parentheses. The controlling variables included in the regressions but not reported in Tables 9 and 10 are found in the column heading for each regression.
TABLE 10: Determinants of the probability of signing a lump sum contract: marginal effect

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>industry region</th>
<th>industry region year</th>
<th>industry region</th>
<th>industry region year</th>
<th>industry region</th>
<th>industry region year</th>
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<td>(3.79)</td>
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<td>(.14)</td>
<td>(1.47)</td>
<td>(1.23)</td>
<td>(.24)</td>
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<td>(1.64)</td>
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<td>(2.00)</td>
<td>(1.76)</td>
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<td>156</td>
<td>156</td>
<td>162</td>
<td>162</td>
<td>156</td>
<td></td>
</tr>
<tr>
<td># of lump sum contracts</td>
<td>45</td>
<td>45</td>
<td>46</td>
<td>46</td>
<td>45</td>
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<tr>
<td>log likelihood</td>
<td>-40.85</td>
<td>-16.18</td>
<td>-42.08</td>
<td>-15.96</td>
<td>-12.51</td>
<td></td>
</tr>
</tbody>
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a The variance of excess returns on the company's stock over the year before the contract divided by the variance over the two previous years.
b See footnote 29
c The coefficient on five year trend of sales/assets if positive, zero otherwise.
d The absolute value of the coefficient on five year trend of sales/assets if negative, zero otherwise.

Note: The coefficients reported in the table are the average change in the probability of observing bonuses if, respectively: the number of workers is increased by 100; the median age is increased by 1 year; the average wage is increased by 10% of the average industry wage; a company goes from not having a predecessor to having one; the other variables are increased by one standard deviation, if different from zero.
Unfortunately, as the tables show, COMPUSTAT and CRSP data do not exist for all of the bargaining units in the contract data set, so that when the two data sets are merged, more than half of the observations are lost. An additional problem is created by the fact that COMPUSTAT contains company-level data while the contracts are at the level of the bargaining unit, so some measurement error is present, particularly for very large companies. Despite these shortcomings, the results obtained from merging the two samples are quite revealing.

Considering the columns of Table 9, the uncertainty measures appear to significantly affect the probability that a bonus contract is signed. Positive variability has more explanatory power (a larger t-statistic) within industry and region (column 3), but this might mainly be due to the fact that most of the lump sum contracts came in the later eighties when times were relatively better than in the early eighties. When we control for this effect by including year dummies as well (columns 4 and 5), the positive variability measure loses statistical significance and the negative variability measure gains explanatory power. The stock price uncertainty measure appears to have explanatory power both within and across years (columns 1, 2 and 5).

In terms of marginal effects, looking at Table 10, a one standard deviation increase in positive variability increases the probability of signing a lump sum contract by 2.9 percentage points (after controlling for industry and region - column 3). The same variation in negative variability increases the probability by 4.0 - 5.1 points (after controlling for industry, region and years - columns 4 and 5). A one standard deviation increase in stock uncertainty raises the probability
by more than 6 percentage points whether or not we control for years. Including all three measures of uncertainty (column 5) does not seem to diminish the effect of any of them; the stock market and product market measures of uncertainty appear to contribute to the probability of signing bonus contracts independently from each other. We conclude from these results that the more uncertain a firm's environment (i.e. the larger the deviation of sales/assets from trend in the year before the contract compared to the five years before the contract or the larger the variance of excess returns of the firm's stock compared to the recent past), the more likely it is that the firm will shift to a lump sum bonus contract.

Turning to the proxies for the existence of an expansionary or concessionary environment, a worsening of negative performance increases the probability of signing lump sum bonus agreements after controlling for industry, region and year. We interpret this result as supporting the hypothesis that bonuses are more likely to appear in concessionary environments, along the lines described in Scenario 3c above. However, an increase in positive performance also significantly increases the probability of signing lump sum contracts both within industries and regions and after controlling for years as well. Insofar as we can infer from a positive trend on sales/assets in the past that the firm will be hiring in the future and so will reap the benefits of imposing a subtle two-tier system soon, we take this as tentative evidence in favor of Scenario 3b. In short, these results suggest that both firms that are doing very well and firms that are doing very poorly are more likely to adopt bonus systems, ceteris paribus, while firms that are not doing
either remarkably well or poorly seem to be less likely to introduce them.

The next interesting result concerns the coefficient on the relative wage, which is positive and significant for all the specifications. A marginal increase of 10% in the real base wage at signing relative to the average industry wage increases the probability of signing a bonus contract by 5.9 - 6.9 percentage points, depending on the specification (Table 10). This provides weak evidence for the version of the "concession theory" of bonuses according to which they appear where the base wage is high and so serve to bring it back into line with the firm's competitors.

The median age is positive and significant in two of the specifications, when we do not control for years. This positive coefficient suggests that bonuses are more likely to appear where the workforce is older, which contradicts the prediction of scenario 3b that bonuses should appear where there are more young workers. This is an interesting result, although it probably does not adequately address the key issue of expected tenure. We wonder whether there is some reason that older workers might prefer bonuses or whether there is some characteristic of industries which employ older workers (and perhaps are not hiring young workers) which leads the firms within them to favor bonuses.

The geographic imitation dummy has a lot of explanatory power within industries and regions; the industry imitation dummy somewhat less. Not only are they generally statistically significant, they also increase the probability by a great deal: going from having no
predecessors with bonus contracts within the same industry to having at least one increases the probability of signing a lump sum contract by 0.7 - 13.9 points, while for geographic region, the increase ranges from 3.5 - 32.6 points (Table 10). When we control for years as well, these effects goes away. This is not surprising for the industry imitation dummy, since many of the contracts in the same industry (e.g. aerospace, automobiles) are negotiated in the same year, and so any imitation effect should be swamped by a year effect; the fact that the year dummies also swamp the geographic imitation dummy is more puzzling. On balance, we take these results as evidence that some sort of "patterning" is occurring.

In summary, the logit results indicate that bonus systems do not systematically appear in large firms and are more likely to appear where the workforce is older. There is evidence that they are associated with concessionary environments, in that they appear where the base wage is high relative to the rest of the industry and when performance is down. These provisions also seem to show up in firms that are doing particularly well. There is evidence that there is pattern bargaining occurring in the sense that bargaining units are more likely to adopt them if another bargaining unit in the same industry or region has done so in the past. Finally, "uncertainty", in the form of an unusually large shock in the year before the contract, tends to increase the probability of a lump sum settlement.
Conclusions

This chapter has presented evidence on the growing diffusion of a compensation innovation that has been relatively neglected by researchers until now; namely, lump sum bonus systems. Possible scenarios explaining the basic nature and causes of bonus systems have been laid out, and empirical evidence designed to distinguish among them has been presented. The estimation of wage growth equations shows that variables indicating the presence and the size of bonuses have positive coefficients; this suggests that the adoption of a bonus system is most likely not just a short-run tactic to cut labor costs within the present contract, but rather a more sophisticated arrangement such that any cost savings for the firm can only be anticipated for the future when the bonus may be discontinued in subsequent agreements. In particular, within a concessionary environment, these results suggest that workers, while perhaps receiving less than what they were getting in the past, still receive more than what they would have gotten in the same concessionary environment under a traditional wage contract. Logit regressions indicate that increases in uncertainty significantly raise the probability of signing bonus contracts.

While none of the evidence presented is conclusive in itself, taken together these results support the view that bonuses can be understood as pay increases on which the firm maintains an option of non-renewal. Present workers must consequently be compensated for this option, the value of which increases with uncertainty, largely at the expense of future workers. If this line of reasoning is accurate, it allows us to interpret the apparently puzzling fact that unions generally vehemently
oppose bonus systems but can rarely generate strikes against them: while portions of the existing workforce, particularly young and low tenure workers, might favor these systems, unions may well oppose them on behalf of yet-to-be-hired workers and the remainder of the present workforce.
References


U.S. Chamber of Commerce, Employee Benefits, various issues.


CHAPTER II

EFFECTS OF FLEXIBLE COMPENSATION SYSTEMS ON COMPANY LEVERAGE:
An example of interaction between labor and financial markets

Two recent phenomena in the U.S. corporate world have been the focus of increasing attention: on the one hand, the wide diffusion of new compensation systems has undermined the stability and the continuity of the old post-war regime of wage determination; on the other hand, debt has been increasingly favored by U.S. companies as a form of outside financing, leading many commentators to suggest the existence of a "corporate debt crisis" and to fear its implications for the stability of the economy. To the best of my knowledge virtually no consideration has been given to the possibility of interactions between the two phenomena. Although these interactions are probably unlikely to provide a complete explanation of what has been recently observed in labor and financial markets, valuable information can yet be learned from their consideration.

In order to describe a specific setting in which uncertainty might affect the firm's decision to shift to a flexible compensation system, the focus of this chapter is on the joint analysis of two decision

---

1 See, for example Bernanke and Campbell (1989) and Warshawsky (1990).
2 One important exception is Blanchard (1989). I would like to thank Olivier Blanchard for suggesting to me the idea of working on this problem.
processes characterizing a firm: the determination of the desired amount of debt on the financial side and the determination of the compensation package on the labor market side. A secondary goal of the analysis is to show that the interactions between these two decision processes not only exist, but might be important beyond an understanding of the flexible compensation phenomenon.

The nature of the linkages between the financial and the labor market sides of a firm is suggested by the following considerations. A traditional wage system can be described as a system in which the union and the firm bargain ex ante over a compensation level that does not depend on the state of the world. Under this regime the wage and the interest earned by debt holders share a common feature: they both represent a predetermined fixed claim on the value of the firm. On the other hand, a profit sharing system can be described as a system in which the union and the firm bargain ex ante over a compensation schedule that does depend on the state of the world. In this case, the flexible compensation earned by workers is no longer a predetermined fixed claim but becomes a residual claim on the value of the firm: a claim that is somewhat similar to the dividend earned by stock holders.

When a firm shifts from a traditional wage system to a profit sharing system, the ratio between fixed claims and residual claims on the labor market side changes. In particular the fraction of residual claims increases. As a result, the risk of defaulting on any fixed claim is likely to be reduced with possibly important effects on the behavior of those agents who are affected by the existence of a positive probability of bankruptcy. Among these agents are potential new debt
holders, who anticipate the existence of bankruptcy costs and include them in the price they impose on the firm for the debt they are willing to acquire. The larger the amount of debt that is issued by the firm, the larger is the bankruptcy risk and the related payment required by new debt holders in case of no bankruptcy. So a positive probability of bankruptcy and the related bankruptcy costs imply that the borrowing interest rate for the firm is higher than the riskless interest rate. If the introduction of profit sharing reduces the risk of bankruptcy, the cost of new debt faced by the firm decreases ceteris paribus.

Hence, flexible compensation systems offer a financial gain to the firm; a gain that is larger the larger the reduction in the default risk and the larger the effect of the default risk on the cost of debt. Those firms for which this financial gain is sufficiently attractive might be expected to be the ones that abandon the fixed wage system and at the same time increase their leverage. This second effect is the result of the more favorable debt pricing rule they face for the issuance of new debt, conditional on the introduction of profit sharing.

These considerations suggest that interactions between the choice of a compensation system and the issuance of new debt might well exist. Section II.2 of this chapter will characterize the precise nature of

---

3 These costs may be defined as "external drains of cash away from the firm" associated with formal bankruptcy proceedings. "Cash may flow in the direction of lawyers, trustees, or accountants who execute the bankruptcy proceedings; to government, as a result of the loss of corporate tax shields, such as loss carry forwards; or to competing firms, as a result of any disruption that occurs in the relationships between the firm and the suppliers and customers." (Barnea, Haugen, Senbel 1985, p.53).
these interactions with the help of a model and of simulation results. However, before moving to the theoretical analysis, Section II.1 will estimate an econometric model aimed at showing that such interactions do actually exist in the data\(^4\). The concluding section will discuss possible extensions of the analysis concerning the relation between the introduction of profit sharing, the debt to equity ratio and the control over the firm.

II.1 **Empirical evidence on the relation between flexible compensation systems and debt issuance**

II.1.1 AN ECONOMETRIC MODEL AND THE HYPOTHESES TO BE TESTED

Consider the following model for the issuance of debt:

1) \[ \Delta D_t = \lambda \left[ D^*_t - D_{t-1} \right] + \epsilon_t \]

where \( \Delta D_t \) is the net issuance of new debt\(^5\) in period \( t \), while \( D_{t-1} \) and \( D^*_t \) are respectively the actual level of debt at the beginning of the period and the desired level at the end. The equation says that the net issuance of new debt in each period is a fraction \( \lambda \) of the difference between the desired level and the starting level of debt, plus a white noise error term\(^6\).

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\(^4\) The reader who prefers to first see the theoretical foundations of the econometric model is invited to start from Section II.2.

\(^5\) Here and in the rest of this section by debt is meant long term debt normalized by total assets; this is, in fact, the actual variable used in the regressions described below.

\(^6\) Note that if \( \lambda = 1 \) the model implies full adjustment to the desired level of debt in each period.
The desired level of debt is assumed to be a function of a set of firm's characteristics, $X_t$, and of the cost of borrowing, $R_t$, faced by the firm.

2) $D_t^* = X_t \beta - R_t$

The substitution of (2) into (1) yields an equation for the demand of new debt by the firm as a function of its characteristics, its level of outstanding debt and the cost of borrowing:

3) $\Delta D_t = X_t \beta \lambda - \lambda R_t - \lambda D_{t-1}$

$R_t$ is a crucial variable in what follows. The existence of an interaction between the issuance of debt and the choice of the compensation system hinges on the hypothesis that the cost of borrowing differs according to the compensation system chosen by the firm. This because, for any firm, the higher the default risk, the higher the price of debt and the lower the desired level of debt. However, for a firm adopting profit sharing the default risk is smaller because workers' compensation is flexible; therefore, financial markets charge, ceteris paribus, a lower price for the new debt that a profit sharing firm is willing to issue. Hence, there are two possible regimes for $R_t$:

4) $R_t = \begin{cases} 
R^W_t = x_t \beta + \delta^W D_{t-1} & \text{under a fixed wage system} \\
R^P_t = x_t \beta + \delta^P D_{t-1} & \text{under a profit sharing system} 
\end{cases}$

The level of outstanding debt determines the probability of bankruptcy

---

7 See Section II.2 for the analysis of the theoretical foundations of this hypothesis.
faced by the firm and hence the price charged by potential new debt holders who anticipate the existence of bankruptcy costs; however, at any level of $D_{t-1}$, if the flexible compensation system reduces the default risk, the price charged is *ceteris paribus* lower; so, $\delta^w > \delta^p$. The observable variables in $X_t$ are, instead, restricted not to have any differential effect on the cost of debt.

On the labor market side, the introduction of profit sharing is subject to a decision process according to which the entrepreneur compares the benefit of the change of compensation system with its cost and chooses the solution that ensures the highest firm's value. Let $Z^*_t$ be a latent variable characterizing the outcome of this decision process. If the latent variable is greater than zero the benefit of the introduction of profit sharing exceeds the cost, and the flexible compensation system is adopted.

---

8 Note that the issuance of new debt is assumed to be irrelevant in comparison to the level of outstanding debt; hence the bankruptcy risk is just a function of existing debt. The implications of relaxing this assumption will be considered below.

9 Removing this assumption would not add any insight into the description of the model and would only complicate the analysis. On the other hand, in the actual estimation of the model, allowing for a completely unrestricted determination of the effects of the observable variables $X$ under the two regimes would, in principle, be preferable. It is, however, prevented by the size and the characteristics of the sample that will be used. The constrained estimation that will be described below is, nevertheless, informative since its goal is just to show the existence of a profit sharing effect. If this effect were not in the data, then the two parameters $\delta$ that are allowed to differ would be estimated to be equal and no constraint would be binding for the other parameters.

10 See again, Section II.2 for a justification of this approach.
5) \[ Z^*_t = Y_t \gamma + (\delta^W - \delta^P)D_{t-1} - \Psi_t \]

The net benefit of the introduction of profit sharing is assumed to be a function of a set of observable firm's and workers' characteristics, denoted by \( Y_t \). In addition, if among the benefits of profit sharing there is also the financial gain generated by the lower cost of debt, then this financial gain must increase the value of the latent variable \( Z^*_t \). On the other hand, the variable \( \Psi_t \) represents the unobservable components of the cost of adopting profit sharing that are not captured by \( Y_t \). These components include the cost of overcoming the inertia that characterizes industrial relation systems and the premium that must be paid to risk averse workers in order to have them accept a flexible compensation system\(^{11}\). Let \( Z_t \) be an indicator variable taking value 1 if profit sharing is adopted; then

6) \[ Z_t = \begin{cases} 1 & \text{if } \Psi_t < Y_t \gamma + (\delta^W - \delta^P)D_{t-1} \\ 0 & \text{if } \Psi_t > Y_t \gamma + (\delta^W - \delta^P)D_{t-1} \end{cases} \]

Denoting with \( G \) the cumulative distribution of the unobservable cost component \( \Psi \), the probability of introducing profit sharing is

7) \[ \Pr(Z_t = 1) = G[Y_t \gamma + (\delta^W - \delta^P)D_{t-1}] \]

and this is an increasing function of the spread between \( \delta^W \) and \( \delta^P \).

The story behind the above equations is clarified by the figure in the following page. Consider two firms, i and j, that are identical in

\(^{11}\) Workers' risk aversion is the source of cost that will be explicitly modeled in Section II.2.
PROFIT SHARING AND DEBT ISSUANCE

\[ \Delta D = \lambda \beta - \lambda R - \lambda D(-1) \]

\[ R = \delta D(-1) + \lambda \beta \]

\[ (\delta - \delta') D(-1) + \lambda \beta \]

COST AND BENEFIT OF PROFIT SHARING

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all respects except for the (unobservable) cost of introducing profit sharing; in particular assume that $\psi_j > \psi_i$. The north-east quadrant of the figure measures the cost of debt $R$ on the vertical axis and the outstanding level of debt $D_{-1}$ on the horizontal axis. The two schedules in the quadrant represent the cost of debt under the two compensation regimes. Given that the two firms differ only because of $\psi$, they both face the same two schedules. The spread between the two costs of borrowing increases linearly with the level of outstanding debt.

The south-east quadrant measures the cost and the benefit of introducing profit sharing on the vertical axis. Both firms face the same linear schedule for the benefit; its slope is equal to the vertical difference between the two debt pricing schedules represented in the north-east quadrant. The two costs of introducing profit sharing, $\psi_i$ and $\psi_j$, are instead different, as already mentioned.

Fix the level of outstanding debt $D_{-1}$, at the same value for both firms. To make things interesting this level is such that for firm $i$ the benefit of profit sharing is larger than the cost, while for firm $j$ the opposite is true. Then, firm $i$ introduces profit sharing and, consequently, the effective cost of debt it faces is determined by the lower schedule in the north-east quadrant; given $D_{-1}$ this cost is $R_i$ on the vertical axis. On the contrary firm $j$ does not introduce profit sharing and hence it faces the higher effective cost of borrowing represented by $R_j$.

The north-west quadrant has on the horizontal axis the issuance of new debt. The downward sloping schedule in the quadrant is the demand for new debt specified in the equation (3) of the model. Both firms face
the same demand schedule for new debt as a function of the cost of borrowing, given that they are observationally identical. However, because of the different compensation systems, financial markets charge a different price to the two firms for the new debt they are willing to issue. Given that the demand schedule is downward sloping, firm i, that faces the lower cost of borrowing, issues more new debt.

In conclusion, the main empirical prediction of the above analysis is that, controlling for the level of outstanding debt, firms adopting profit sharing issue more new debt\textsuperscript{12}. This empirical prediction can be tested using the following approach. Given the indicator function \(Z_t\), the substitution of equation (4) into equation (3) yields

\[
8) \quad \Delta D_t = X_t \beta - \lambda D_{t-1} - \lambda \delta^D_{t-1}Z_t - \lambda \delta^W_{t-1}(1-Z_t) + \epsilon_t
\]

where \(\beta = \lambda(\bar{\beta} - \bar{\beta})\). Rearranging the terms involving \(Z_t\), the basic estimated equation is:

\[
9) \quad \Delta D_t = X_t \beta - \lambda(1+\delta^W)D_{t-1} + \lambda(\delta^W - \delta^P)D_{t-1}Z_t + \epsilon_t
\]

\[
\Delta D_t = X_t \beta - \delta D_{t-1} + \mu D_{t-1}Z_t + \epsilon_t
\]

The estimation of this equation offers a very simple way to test the existence of an effect of profit sharing on the cost of debt and hence on the issuance of new debt. In the absence of any effect, the spread between \(\delta^W\) and \(\delta^P\) is necessarily equal to zero:

\textsuperscript{12} Note that this story hinges on the assumption that the unobservable cost \(\bar{\psi}\) of introducing profit sharing is independent from the level of outstanding debt.
10) \( H_0: \delta^W - \delta^P = 0 \implies \mu = 0 \)

Hence, the null hypothesis that profit sharing has no effect on the issuance of debt can be framed as the hypothesis that the coefficient \( \mu \) on \( D_{t-1}Z_t \) is zero in equation (9).

In the above analysis, the decision to introduce profit sharing depends on the spread between the costs of debt under the two regimes, but does not depend on the actual amount of new debt issued by the firm\(^{13}\). In other words, this implies that \( Z_t \) is predetermined in equation (9). Under this assumption, (9) can be estimated using Ordinary Least Squares (OLS), and, consequently, the hypothesis (10) can be tested using the OLS results.

However, there are reasons to suspect the existence of a simultaneity problem. For example, suppose that the cost of debt is a function not only of the outstanding level of debt but also of the amount of new debt issued by the firm\(^{14}\). Under this assumption, equation (4) becomes

\[
11) \quad R_t^* = \begin{cases} 
R_t^W = x_t \bar{\beta} + \delta^W(D_{t-1} + \Delta D_t) & \text{under a fixed wage system} \\
R_t^P = x_t \bar{\beta} + \delta^P(D_{t-1} + \Delta D_t) & \text{under a profit sharing system}
\end{cases}
\]

On the labor market side, the equation (5) for the latent variable \( Z_t^* \) has to be modified accordingly. The financial gain offered by the

\(^{13}\) See the footnote 8 and the figure on page 75.

\(^{14}\) In the one period model discussed in Section II.2, in which the issuance of new debt and the total amount of debt coincide, this is in fact the case.
introduction of profit sharing is now

12) \[ R^W_t - R^P_t = (\delta^W - \delta^P)(D_{t-1} + \Delta D_t) \]

and the latent variable \( Z^*_t \) is equal to

13) \[ Z^*_t = Y_{t-1} + (\delta^W - \delta^P)(D_{t-1} + \Delta D_t) - \Psi_t \]

Hence, the probability of introducing profit sharing, i.e. the probability that the indicator function \( Z_t \) takes value 1, becomes

14) \[ \Pr(Z_t = 1) = G[Y_{t-1} + (\delta^W - \delta^P)(D_{t-1} + \Delta D_t)] \]

where \( G \) is the cumulative distribution of the unobservable cost component \( \Psi_t \).

In this modified framework, the OLS estimation of \( \mu \) in equation (9) is consistent only under the null hypothesis that there are no interactions between the profit sharing decision and the financial decision: in fact, only under this hypothesis, \( Z_t \) would be independent from \( \Delta D_t \). Nevertheless, if, using OLS, the test on the coefficient \( \mu \) in equation (9) rejects the hypothesis that it is equal to zero, this can still be considered as evidence in favor of the existence of the suggested financial effects of profit sharing. In other words, if the null hypothesis is rejected in the OLS estimation, then profit sharing affects debt issuance but the equation has to be estimated using Instrumental Variables (IV). For this purpose, I use, as instruments for \( D_{t-1} * Z_t \) in equation (9), the lagged exogenous variables \( X_{t-1} \) that determine the desired level of debt \( D^*_t \) in the previous period. This is
a set of legitimate instruments as long as it shifts $D_{t-1}$ without being correlated with the indicator variable $Z_t$.  

In summary, using the two different samples described below the econometric analysis of the data will follow these steps:

a) Equations like (9) will be estimated using OLS in order to test if the coefficient on $D_{t-1}Z_t$ is different from zero.

b) A positive and significant coefficient in the OLS regression will be considered as evidence of the existence of the suggested interactions between compensation and financial decisions. However, the possibility of a simultaneity problem under the alternative hypothesis requires the use of Instrumental Variables in order to obtain a consistent estimate of the coefficient on $D_{t-1}Z_t$. So equation (9) will also be estimated with IV, using the set of instruments described above.

c) One of the two samples used in the analysis allows for an estimation of the probability of introducing a flexible compensation system; using that sample, a Logit regression based on the equations (5), (6) and (7) will be estimated in order to test if, as the model predicts, the level of outstanding debt increases the probability of adopting a flexible compensation system.

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15 More precisely these instruments will include the lagged values of Retained Earnings, Operating Income, Plant & Equipment, Inventories, Cash and Receivables, Other Assets and % Growth of Sales; each variable is divided by the lagged value of Total Assets.
II.1.2 THE DATA

To the best of my knowledge, no publicly available unified source of data contains information on labor contracts and financial variables by firm. Hence, each of the two data sets I use for the empirical analysis is the combination of different sources and is far from containing the ideal information one would like to have in order to analyze the issues raised in this chapter. The first one is, nevertheless, a fairly rich data set on the details of 455 manufacturing union contracts, signed between 1982 and 1987, with additional information obtained from COMPUSTAT\textsuperscript{16}. The data were originally collected by Vroman and Abowd (1988) with significant additions made by Hirtle (1986)\textsuperscript{17}. In particular, thanks to Hirtle's work, the data set provides not only information on the wage increases and Cost of Living Adjustments (COLA) in each contract, but also information on the base wage at signing\textsuperscript{18}.

As far as flexible compensation systems are concerned, this data set contains separate information on the existence of profit sharing and lump sum bonus clauses. For the second type of compensation innovation also the amount of the bonus is given. Unfortunately, for profit

\textsuperscript{16} COMPUSTAT is a computerized data bank containing legally required balance sheet and income data for publicly traded companies.

\textsuperscript{17} The original source of the data was the BLS publication \textit{Current Wage Developments}. The lump sum bonuses information comes from a separate BLS data source and was added by Chris Erickson and myself (see Chapter 1 of this thesis). I am grateful to Henry Farber at MIT, John Abowd at Cornell and Janice Murphy at the BLS for giving me access to the various parts of the data.

\textsuperscript{18} This is the same source of information that was used in Chapter 1 to analyze the diffusion of lump sum bonus contracts.
sharing, the size of the flexible component of the compensation package is not provided. Lump sum bonus clauses, that have been discussed at length in Chapter 1, appear in 66 settlements, while profit sharing clauses are recorded for only 22 settlements. Other sources of information on the prevalence of non-traditional compensation systems in the US Economy (see for example Table 2 in the Introduction) suggest that profit sharing contracts are somewhat under represented in this sample. Furthermore, because of the low absolute number of these contracts in the sample, the results derived from this source of information are preliminary and require confirmation from larger and more representative sources.

This data set on labor contracts does not contain any information on financial variables and on other characteristics of the firms. In order to obtain this information I merged the data set with COMPUSTAT. Unfortunately, in this way more than half of the observations on settlements are lost because they refer to companies that are not recorded in COMPUSTAT.\textsuperscript{19}

\textsuperscript{19} There are 100 COMPUSTAT firms for which one or more settlements are recorded in the contract data set. The total number of contracts in the merged data set is 235 but, because of missing information on several COMPUSTAT variables, the effective sample size changes according to the variables considered in the analysis and it is in general much lower. It is reassuring, however, for the results of the analysis, that the number of profit sharing firms for which a full set of information is available does not decrease as much as the overall sample. More precisely the analysis will be based on 159 companies of which 16 have profit sharing.

It must be noticed that an observation in the merged data set refers to a contract in a given year. If a firm signs two contracts, with two different unions in the same year, the sample contains two observations that are different for the settlement variables but identical for the COMPUSTAT firm variables. This in fact happens in 27 cases.
Tables 1 and 2 - at the end of Section II.1 - offer a preliminary descriptive picture of the relation between profit sharing and debt issuance in this sample. For the 16 settlements of the merged data set in which a profit sharing clause appears, the third column of Table 1 reports the net amount of new long term debt issued by the corresponding firm in the year in which a labor contract is signed, normalized by total assets\(^{20}\). The third column of Table 2 reports, instead, the level of long term debt, normalized by assets, in the year before the contract is signed\(^{21}\). As a term of comparison the last column of the two Tables shows the corresponding two digits SIC industry averages.

The figures reported in the last row of Table 1 indicate that profit sharing firms seem to issue on average almost 10 times more debt, as a ratio of their assets, than non profit sharing firms in the year in which a new contract is signed.\(^{22}\) The last row of Table 2 shows that the same firms have on average a slightly higher, although not statistically different, level of long term debt, normalized by assets, in the year before the profit sharing contract is signed. I interpret these results as weakly suggesting the existence of a relation between the

\(^{20}\) The variable is constructed as the difference between Issuance of Long Term Debt (COMPSTAT data item 111) minus Reduction of Long Term Debt (COMPSTAT data item 114), divided by Total Assets (COMPSTAT data item 6).

Note that Caterpillar in 1983 and 1986 and General Motors in 1984 and 1987 each signed two profit sharing contracts with two different unions. Hence the table reports 12 observations, instead of 16, of which the 4 just mentioned refer to two contracts each.

\(^{21}\) The variable is obtained as the ratio between Long Term Debt (COMPSTAT data item 9) and Total Assets (COMPSTAT data item 6).

\(^{22}\) This result must however be considered with caution given that it is essentially driven by four observations.
introduction of profit sharing and the issuance of debt. They also suggest that the relation might take the following form: if a higher leverage in the year before the contract is a factor that increases *ceteris paribus* the cost of issuing new debt, firms in such a situation are the ones that are more likely to be interested in the introduction of profit sharing, in order to reduce the cost of debt; furthermore, if they actually introduce profit sharing these firms face more favorable debt financing conditions and hence, *ceteris paribus*, issue more new debt.

The second data set I use in the empirical analysis has, in comparison to the first, drawbacks and advantages. The main drawback is that it does not provide information on the characteristics of the take-home compensation but only on the characteristics of the portion of the total compensation package accounted for by the pension benefits. Nevertheless, information on the type of pension plan adopted by a firm can still be useful to test the hypothesis that the flexibility of the compensation package affects the debt financing decision of the firm.

For the purpose of this chapter, the distinction between Defined Benefit (DB) pension plans and Defined Contribution (DC) pension plans is the important one. Petersen (1990) has convincingly shown that the "difference in flexibility afforded by the two types of pension plans matters" for an explanation of pension choices, if financial flexibility

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23 The following brief description of the characteristics of DB and DC pension plans draws heavily on the work by Mitch Petersen (1990). I am particularly indebted to Mitch Petersen for providing me with these information and with the data that will be used in the analysis.
has a value for the firm. Under a DB pension plan firms have to make annual contribution to the fund in order be able to pay the final retirement benefit specified by the plan; the contribution must be within the minimum and the maximum limits established by the Federal Government\(^{24}\). These limits prevent the firms from timing the contributions to the fund according to the variations of their revenues and expenses. On the other hand, DC plans allow for a greater flexibility. No minimum payment to the fund is required and the amount of the contribution may be determined by the firm in relation to various indicators of profitability. In particular, the firm is allowed to decide that no contribution is made unless profits exceed a certain level\(^{25}\).

These characteristics of the two types of pension plans suggest that the same considerations outlined in the introduction to this chapter might hold here as well. Firms adopting DC plans are, ceteris paribus, subject to a smaller ratio of fixed versus residual claims. Their capacity of timing the pension contributions with the variations of revenues and other expenses is likely to reduce their default risk.

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\(^{24}\) The minimum limit is imposed to avoid the possibility that firms fail to fund the plan and then default on the pension promise. The maximum limit is imposed to avoid abuses of the tax deducibility of pension contributions.

\(^{25}\) The most common form of DC plan is the so called Profit Sharing Pension Plan, according to which the firm's contribution is determined as a variable fraction of wages: the fraction changes from year to year as a function of profits. Another common form is the 401(k) plan according to which employees make their before-tax contributions to the plan and the firm matches workers' contributions in a proportion that again depends on profitability.
and the cost of borrowing they face. Hence, also the evidence from this data set appears to be valuable for the purpose of this chapter.

The data were collected from the IRS form 5500: Report of Employee Benefit Plan; all pension plan sponsors are required to file this form each year and for each plan. The fact that filing the form is compulsory under the Federal Law is the basis of the main advantages of this source of information in comparison to the contract data set described above. The size of this sample is far larger than the size of the previous one and, in addition, the sample is more representative of the entire U.S. economy, because it is not limited to the union sector and, within this sector, to the major manufacturing firms included by Vroman and Abowd in their data set.

I limited the analysis to primary pension plans for which a 5500 form was filed in the year 1983. For each pension plan the information concerning its type - DC versus DB - has been matched with financial information about the sponsoring firm obtained from COMPSTAT. Given that, for the purpose of this chapter, the relevant unit of analysis is the firm, all multiple observations referring to firms with more than one pension plan in the same year were dropped. For each firm a variable equal to the fraction of DC pension plans, in relation to the total number of plans, was recorded. This is the variable used in the econometric analysis as an indicator of the flexibility of the

\[28\] Information concerning secondary pension plans have been dropped since these plans are usually introduced for tax arbitrage reasons or because they are administratively simple ways to account for terminated past pension plans.
compensation package.

Tables 3 and 4 report, for this sample as well, a preliminary descriptive picture of the relation between profit sharing and debt issuance. Table 3 shows the average net amount of new long term debt, normalized by total assets, issued by firms that sponsor at least one DC pension plan as opposed to the average net amount issued by all the remaining firms sponsoring DB plans. As in the first data set, flexible compensation firms appear to issue on average more new debt, although the difference is statistically not significant. Table 4 shows, instead, the average level of outstanding debt for the two type of firms. Here, in contrast with what expected, DB firm have on average a higher degree of leverage, but the difference is again not significant. In any case, the indicators described so far do not control for firms' specific characteristics that might drive the issuance and the level of debt. The econometric analysis contained in the next section is aimed at controlling for these characteristics.

II.1.3 EMPIRICAL RESULTS

Starting with the first data set, based on union contracts, Table 5 describes the results of the estimation of equation (9) by Ordinary Least Squares (OLS) and by Instrumental Variables (IV).

The OLS results, reported in the second column of the table, show that the lagged level of the debt to asset ratio has a negative effect on the issuance of new debt. On the other hand, the coefficient of the same variable in interaction with the profit sharing dummy is estimated to be positive and significantly different from zero. Hence, the OLS
regression rejects the null hypothesis that the introduction of profit sharing and the issuance of new debt are independent. As noted in Section II.1.1, however, the OLS estimate of the interaction coefficient might be biased by the endogeneity of the profit sharing dummy. In order to obtain a consistent estimate of that coefficient I estimated the equation using as instruments the lagged exogenous determinants of the desired level of debt. In the last column of Table 5, the Instrumental Variables regression confirms a positive and significant estimate of the effect of the interaction term on the issuance of new debt. Note that these results are conditional on a fairly large set of controls that include the base wage at signing and current budget variables like retained earnings, operating income, inventories and different types of assets. In addition, various measures aimed at capturing shocks to the firm's performance and the degree of uncertainty perceived by the firm, have been included: these variables are, the growth of sales, the five year trend of sales/assets, the average stock market return, the variability of stock market returns and the positive or negative deviations of sales/assets from the trend in the year before the contract, normalized by the sum of the absolute deviations in the previous years. Finally two digit industry dummies and year dummies

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27 As already mentioned in the footnote 15 I used the lagged values of Retained Earnings, Operating Income, Plant & Equipment, Inventories, Cash and Receivables, Other Assets and % Growth of Sales; each variable was divided by the lagged value of Total Assets.

28 A Hausman specification test (see Hausman 1978) rejects the hypothesis of exogeneity of the interaction variables.

29 The last six variables in the Tables 6, 7 and 8 have already been introduced in Chapter 1. See Section I.3.2 for a precise
have also been included.

The economic interpretation is the following. In the absence of profit sharing a larger lagged debt to asset ratio reduces the issuance of new debt for two reasons: first, the higher the outstanding level of debt the lower the required net adjustment to the new desired level, as suggested by equation (1); in addition, the higher the outstanding level of debt, the higher the cost of borrowing and the lower the desired level, as suggested by equations (3) and (4). For profit sharing firms, this second effect is reduced because the default risk is lower, and this is the implication of the positive coefficient on the interaction term.

As far as lump sum bonuses are concerned, it is somewhat puzzling that the coefficient of the interaction term is estimated, in Table 5, to be negative. According to the interpretation of bonus clauses given in the first chapter, also this form of compensation innovation is introduced by firms in order to gain flexibility. The estimated negative coefficient, on the other hand, seems to imply that, whether or not they provide flexibility, bonuses are not perceived by financial markets as factors that reduce the default risk. Hence, their introduction does not allow for a reduction of the cost of debt; more than that, within the framework of this econometric model the negative coefficient seems to imply that their presence increases the cost of borrowing faced by the

characterization of these variables and of the way they have been constructed. Note that given how equation (9) has been derived, the estimated coefficients of all the controls do not have a clear structural interpretation.
firm.

This result may appear less puzzling in the light of the following considerations. First, the flexibility offered by profit sharing is much more significant than the flexibility offered by bonuses because bonuses are predetermined in their size and in the timing of the correspondent payments for the entire duration of the contract; hence, the possibility of reducing the compensation package in case of low profitability is only provided by the fact that bonuses, unlike the fixed wage increases, are understood by the bargaining parties as something that can be removed in subsequent contracts. On the other hand, profit sharing payments are not predetermined and might fluctuate immediately according to profitability. Second, lump sum bonuses may represent quite substantial amounts of money, as it was shown in Chapter 1; hence, at the due date, the firm might even encounter situations of financial distress in order to cover the large cash outflow implied by the payment, to each worker, of sums that range from $150 to $2120 for uniform bonuses and from 1.5% to 12% of the previous year's earning for percentage bonuses. In summary, there are reasons to believe that the financial effects of the introduction of lump sum bonuses might very well be the opposite of the effects of the introduction of profit sharing.

Additional evidence supporting the existence of the suggested financial effects of profit sharing is provided by Tables 6 and 7. These tables contain the results of the estimation of equation (9) in the year

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30 See for example Table 2 in Chapter 1.
before and in the year after the signing of the contract. If the introduction of profit sharing reduces the cost of borrowing, innovating firms might be expected to take as much advantage as they can of this opportunity, as soon as it becomes available. In this case those firms that sign a profit sharing contract in a given year should be expected to issue more debt in that year than in the previous or in the following one. If, however, it is costly, for reasons others than the price of debt, to immediately fully adjust to the new desired level, a positive profit sharing effect on the issuance of debt might be observed also in the year after the contract.

The first OLS regression in Table 6 contains dummies for the firms that in the subsequent year sign a flexible compensation contract. The coefficients of the dummies are positive but small and insignificantly different from zero, implying that these firms are not perceived as different from the others by potential debt holders in the year before the contract.\(^{31}\) Likewise, in Table 7, for the year after the contract, the coefficients are estimated to be insignificantly different from zero in both the OLS and the IV regressions. The fact that profit sharing firms behave in a significantly different way only in the year of the contract seems to imply that if the cost of debt is actually reduced because of the outcome of the contract, the firm takes advantage of this

\(^{31}\) For the year before the contract the interaction between lagged leverage and the compensation dummy should not in principle be included unless the outcome of the contract is expected by potential debt holders; to consider this possibility, the second OLS regression in Table 6 contains the interaction terms. The effect is still insignificant for profit sharing while, somewhat surprisingly, becomes positive and significant for lump sum bonuses.
opportunity as much as it can and as soon as possible\textsuperscript{32}.

This observation might also explain the size of the coefficient for profit sharing estimated in Table 5, particularly in the IV regression. This coefficient is rather high given the means of the dependent variable and of the interaction term; however, in addition to the acceleration of the adjustment that the regressions in Tables 6 and 7 seem to imply for the year of the contract, the size of this parameter might not be surprising when the descriptive results shown in Table 1 are taken into account: Table 1, in fact, shows that on average the profit sharing firms in this sample issue, in the year of the contract, ten times more debt than the firms in the same two digit industry.

In order to find more evidence for the hypothesis that firms introducing profit sharing exploit the more favorable debt financing conditions as much as possible, I also estimated equations for the gross issuance of new debt and for the gross retirement of old debt. One might in fact expect the profit sharing firm to roll over old debt at the new more favorable debt financing conditions. This rolling-over effect is however not supported by the data: the gross issuance of new debt is positively and significantly affected by the introduction of profit sharing, but no effect is shown on the gross retirement\textsuperscript{33}.

The last piece of evidence derived from the contract data set is

\textsuperscript{32} Note that the model described in section II.1.1 allows for a full one period adjustment to the desired level of debt if the coefficient $\lambda$ is equal to one; the argument outlined in the text implies that profit sharing firms are characterized not only by a smaller parameter $\delta$ but also by a larger parameter $\lambda$ in the year of the contract.

\textsuperscript{33} The result of these regressions are not reported for space reasons.
described in Table 8. This table reports the estimated coefficients of the Logit regressions on the probability of signing a profit sharing or a lump sum bonus contract. As suggested by equations (5), (6) and (7) of the econometric model, the coefficient of the lagged debt to asset ratio should be significantly positive if, in the comparison between the benefits and the costs of the introduction of profit sharing, the opportunity of reducing the cost of borrowing has any value. The coefficient is in fact estimated to be positive for the profit sharing regression, although it is barely significant. It is, on the other hand, certainly insignificant for lump sum bonuses, suggesting again that this form of compensation innovation does not have the same financial effects of profit sharing.

The last table considered in this section refers to the pension plans data set. The estimated equations are analogous to the ones described above for the first sample; here, however, the flexible compensation system on which the analysis is focused is the Defined Contribution pension plan as opposed to the more rigid Defined Benefit pension plan. As already mentioned in the description of the data set, the unit of observation in these regressions is the firm. The variable that captures the flexibility of the compensation package is the fraction of the total number of pension plans sponsored by the firm, that is accounted for by DC pension plans.

The regressions add supporting evidence for the suggested financial

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Hence, the variable Z in equation (8) has to be interpreted accordingly.
effects of flexible compensation systems. The coefficient of the interaction term is estimated to be positive in both the OLS and the IV regression and it is significant in the first of the two\textsuperscript{35}.

In conclusion, the econometric evidence described in this section seems to support the existence of the suggested financial effects of flexible compensation systems. In the contracts data set, firms introducing profit sharing behave differently in the year in which they sign the contract; in particular, they seem to issue more new debt while the level of their outstanding debt positively affects the probability of adopting the compensation innovation. The pension plans data set, adds some evidence in the same direction, and confirms the existence of large effects on leverage induced by the flexibility of the compensation package. In order to shed more light on the mechanism that might be driving these results and in particular on the possibility that these effects on leverage are due to the more favorable borrowing conditions faced by profit sharing firms because of their lower default risk, I present the analysis of a theoretical model in the next section.

\textsuperscript{35} A Hausman specification test (see Hausman 1978) cannot reject the hypothesis of exogeneity of the interaction variable.
<table>
<thead>
<tr>
<th>BARGAINING UNIT</th>
<th>YEAR</th>
<th>SIC**</th>
<th>FIRM ISSUANCE</th>
<th>INDUSTRY ISSUANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weyerhauser Woodworkers</td>
<td>1986</td>
<td>24</td>
<td>.085</td>
<td>-.003</td>
</tr>
<tr>
<td>Briggs and Stratton Allied Indus. Work.</td>
<td>1983</td>
<td>35</td>
<td>.000</td>
<td>-.005</td>
</tr>
<tr>
<td>Cummings Engine Independents</td>
<td>1987</td>
<td>35</td>
<td>.006</td>
<td>-.005</td>
</tr>
<tr>
<td>Deere and Co. Autoworkers</td>
<td>1983</td>
<td>35</td>
<td>.071</td>
<td>-.005</td>
</tr>
<tr>
<td>Deere and Co. Autoworkers</td>
<td>1987</td>
<td>35</td>
<td>-.047</td>
<td>-.005</td>
</tr>
<tr>
<td>Caterpillar Tractor Machin. &amp; Autowork.</td>
<td>1983</td>
<td>35</td>
<td>-.001</td>
<td>-.005</td>
</tr>
<tr>
<td>Caterpillar Tractor Machin. &amp; Autowork.</td>
<td>1986</td>
<td>35</td>
<td>-.045</td>
<td>-.005</td>
</tr>
<tr>
<td>Chrysler Corporation Autoworkers</td>
<td>1985</td>
<td>37</td>
<td>.140</td>
<td>.007</td>
</tr>
<tr>
<td>Ford Motor Corporat. Autoworkers</td>
<td>1984</td>
<td>37</td>
<td>-.002</td>
<td>.007</td>
</tr>
<tr>
<td>Ford Motor Corporat. Autoworkers</td>
<td>1987</td>
<td>37</td>
<td>-.008</td>
<td>.007</td>
</tr>
<tr>
<td>General Motor Corp. IUE &amp; Autoworkers</td>
<td>1984</td>
<td>37</td>
<td>-.013</td>
<td>.007</td>
</tr>
<tr>
<td>General Motor Corp. IUE &amp; Autoworkers</td>
<td>1987</td>
<td>37</td>
<td>.096</td>
<td>.007</td>
</tr>
<tr>
<td><strong>SAMPLE AVERAGES</strong></td>
<td>---</td>
<td>---</td>
<td>.019</td>
<td>.002</td>
</tr>
</tbody>
</table>

* Issuance minus reduction of long term debt, divided by total end of period assets; the industry column reports the average for the non profit sharing firms in the same 2 digit SIC industry.

** 2 digit SIC classification of the corresponding firms:
24: lumber and wood product;
35: machinery except electrical;
37: transportation equipment;
TABLE 2: LEVEL OF LONG TERM DEBT IN THE YEAR BEFORE A PROFIT
SHARING CONTRACT IS SIGNED

<table>
<thead>
<tr>
<th>BARGAINING UNIT</th>
<th>** YEAR **</th>
<th>*** SIC ***</th>
<th>FIRM LEVEL</th>
<th>INDUSTRY LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weyerhauser Woodworkers</td>
<td>1986</td>
<td>24</td>
<td>.205</td>
<td>.204</td>
</tr>
<tr>
<td>Briggs and Stratton Allied Indus. Work.</td>
<td>1983</td>
<td>35</td>
<td>.000</td>
<td>.140</td>
</tr>
<tr>
<td>Cummings Engine Independents</td>
<td>1987</td>
<td>35</td>
<td>.160</td>
<td>.140</td>
</tr>
<tr>
<td>Deere and Co. Autoworkers</td>
<td>1983</td>
<td>35</td>
<td>.153</td>
<td>.140</td>
</tr>
<tr>
<td>Deere and Co. Autoworkers</td>
<td>1987</td>
<td>35</td>
<td>.259</td>
<td>.140</td>
</tr>
<tr>
<td>Caterpillar Tractor Machin. &amp; Autowork.</td>
<td>1983</td>
<td>35</td>
<td>.331</td>
<td>.140</td>
</tr>
<tr>
<td>Caterpillar Tractor Machin. &amp; Autowork.</td>
<td>1986</td>
<td>35</td>
<td>.195</td>
<td>.140</td>
</tr>
<tr>
<td>Chrysler Corporation Autoworkers</td>
<td>1985</td>
<td>37</td>
<td>.083</td>
<td>.129</td>
</tr>
<tr>
<td>Ford Motor Corporat. Autoworkers</td>
<td>1984</td>
<td>37</td>
<td>.113</td>
<td>.129</td>
</tr>
<tr>
<td>Ford Motor Corporat. Autoworkers</td>
<td>1987</td>
<td>37</td>
<td>.056</td>
<td>.129</td>
</tr>
<tr>
<td>General Motor Corp. IUE &amp; Autoworkers</td>
<td>1984</td>
<td>37</td>
<td>.077</td>
<td>.129</td>
</tr>
<tr>
<td>General Motor Corp. IUE &amp; Autoworkers</td>
<td>1987</td>
<td>37</td>
<td>.131</td>
<td>.129</td>
</tr>
<tr>
<td>SAMPLE AVERAGES</td>
<td>--</td>
<td>---</td>
<td>.156</td>
<td>.139</td>
</tr>
</tbody>
</table>

* Long term debt divided by total end of period assets; the industry column reports the average for the non profit sharing firms in the same 2 digit SIC industry.

** Contract year.

** 2 digit SIC classification of the corresponding firms:
24: lumber and wood product;
35: machinery except electrical;
37: transportation equipment.
TABLE 3: AVERAGE NET ISSUANCE OF LONG TERM DEBT BY TYPE OF PENSION PLAN

<table>
<thead>
<tr>
<th>YEAR</th>
<th>DEFINED CONTRIBUTION SAMPLE</th>
<th>ISSUANCE</th>
<th>DEFINED BENEFIT SAMPLE</th>
<th>ISSUANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>275</td>
<td>.008 (.096)</td>
<td>634</td>
<td>-.008 (.078)</td>
</tr>
</tbody>
</table>

* Issuance minus reduction of long term debt, divided by total end of period assets.

Note: Standard errors are shown in parentheses.

TABLE 4: AVERAGE LAGGED LEVEL OF LONG TERM DEBT BY TYPE OF PENSION PLAN

<table>
<thead>
<tr>
<th>YEAR</th>
<th>DEFINED CONTRIBUTION SAMPLE</th>
<th>ISSUANCE</th>
<th>DEFINED BENEFIT SAMPLE</th>
<th>ISSUANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>275</td>
<td>.178 (.171)</td>
<td>634</td>
<td>.195 (.134)</td>
</tr>
</tbody>
</table>

* Long term debt divided by total end of period assets.

Note: Standard errors are shown in parentheses.
### TABLE 5: NET ISSUANCE OF LONG TERM DEBT AND COMPENSATION SYSTEM

(Contract year)

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>MEANS</th>
<th>OLS</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit Sharing Dummy</td>
<td>.017</td>
<td>.285</td>
<td>1.454</td>
</tr>
<tr>
<td>*Lagged Debt/Assets</td>
<td>.035</td>
<td>-.099</td>
<td>-.659</td>
</tr>
<tr>
<td>Lump Sum Bonus Dummy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Lagged Debt/Assets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lagged Debt to Assets Ratio</td>
<td>.166</td>
<td>-.440</td>
<td>-.941</td>
</tr>
<tr>
<td>Base Wage at Sign. / Operating Income</td>
<td>.333</td>
<td>.007</td>
<td>.012</td>
</tr>
<tr>
<td>Retained Earnings / Total Assets</td>
<td>.366</td>
<td>-.320</td>
<td>-.511</td>
</tr>
<tr>
<td>Operating Income / Total Assets</td>
<td>.134</td>
<td>.092</td>
<td>.493</td>
</tr>
<tr>
<td>Plant &amp; Equipment / Total Assets</td>
<td>.433</td>
<td>-.027</td>
<td>-.184</td>
</tr>
<tr>
<td>Inventories / Total Assets</td>
<td>.178</td>
<td>-.832</td>
<td>-.615</td>
</tr>
<tr>
<td>Cash &amp; Receivables / Total Assets</td>
<td>.243</td>
<td>.033</td>
<td>-.284</td>
</tr>
<tr>
<td>Other Assets / Total Assets</td>
<td>.200</td>
<td>.939</td>
<td>.694</td>
</tr>
<tr>
<td>% Growth of Sales</td>
<td>.029</td>
<td>-.063</td>
<td>-.056</td>
</tr>
<tr>
<td>Positive Shock to Sales</td>
<td>.354</td>
<td>.002</td>
<td>.035</td>
</tr>
<tr>
<td>Negative Shock to Sales</td>
<td>-.557</td>
<td>-.027</td>
<td>-.020</td>
</tr>
<tr>
<td>Positive Trend of Sales</td>
<td>.012</td>
<td>.021</td>
<td>-.170</td>
</tr>
<tr>
<td>Negative Trend of Sales</td>
<td>-.033</td>
<td>-.074</td>
<td>.033</td>
</tr>
<tr>
<td>Average Stock Market Return</td>
<td>-.000</td>
<td>-.256</td>
<td>-.600</td>
</tr>
<tr>
<td>Stock Market Variability</td>
<td>1.243</td>
<td>.011</td>
<td>.015</td>
</tr>
</tbody>
</table>

Note: t statistics are shown in parentheses. The dependent variable, Δ long term debt, has a mean equal to .007. The R-square of the OLS regression is .65; both regressions contain also two digit industry dummies and year dummies.
<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>MEANS (N = 161)</th>
<th>OLS</th>
<th>OLS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit Sharing Dummy</td>
<td>.118</td>
<td>.020</td>
<td>.113</td>
</tr>
<tr>
<td></td>
<td>(1.47)</td>
<td>(1.49)</td>
<td></td>
</tr>
<tr>
<td>Lump Sum Bonus Dummy</td>
<td>.223</td>
<td>.022</td>
<td>.143</td>
</tr>
<tr>
<td></td>
<td>(1.76)</td>
<td>(2.13)</td>
<td></td>
</tr>
<tr>
<td>Lagged Debt to Assets Ratio</td>
<td>.163</td>
<td>-.192</td>
<td>-.252</td>
</tr>
<tr>
<td></td>
<td>(-2.82)</td>
<td>(-3.66)</td>
<td></td>
</tr>
<tr>
<td>Base Wage / Operating Income</td>
<td>.496</td>
<td>-.001</td>
<td>-.001</td>
</tr>
<tr>
<td></td>
<td>(-0.54)</td>
<td>(-0.40)</td>
<td></td>
</tr>
<tr>
<td>Retained Earnings / Total Assets</td>
<td>.373</td>
<td>-.034</td>
<td>-.039</td>
</tr>
<tr>
<td></td>
<td>(-0.74)</td>
<td>(-0.87)</td>
<td></td>
</tr>
<tr>
<td>Operating Income / Total Assets</td>
<td>.136</td>
<td>-.127</td>
<td>-.127</td>
</tr>
<tr>
<td></td>
<td>(-1.37)</td>
<td>(-1.37)</td>
<td></td>
</tr>
<tr>
<td>Plant &amp; Equipment / Total Assets</td>
<td>.432</td>
<td>.024</td>
<td>.016</td>
</tr>
<tr>
<td></td>
<td>(0.35)</td>
<td>(0.25)</td>
<td></td>
</tr>
<tr>
<td>Inventories / Total Assets</td>
<td>.193</td>
<td>-.049</td>
<td>.044</td>
</tr>
<tr>
<td></td>
<td>(-0.28)</td>
<td>(0.25)</td>
<td></td>
</tr>
<tr>
<td>Cash &amp; Receivables / Total Assets</td>
<td>.239</td>
<td>-.095</td>
<td>-.127</td>
</tr>
<tr>
<td></td>
<td>(-1.19)</td>
<td>(-1.58)</td>
<td></td>
</tr>
<tr>
<td>Other Assets / Total Assets</td>
<td>.217</td>
<td>.041</td>
<td>-.071</td>
</tr>
<tr>
<td></td>
<td>(0.23)</td>
<td>(-0.39)</td>
<td></td>
</tr>
<tr>
<td>% Growth of Sales</td>
<td>.011</td>
<td>-.071</td>
<td>-.065</td>
</tr>
<tr>
<td></td>
<td>(-1.44)</td>
<td>(-1.34)</td>
<td></td>
</tr>
<tr>
<td>Positive Shock to Sales</td>
<td>.458</td>
<td>.000</td>
<td>-.001</td>
</tr>
<tr>
<td></td>
<td>(0.04)</td>
<td>(-0.17)</td>
<td></td>
</tr>
<tr>
<td>Negative Shock to Sales</td>
<td>-.526</td>
<td>-.008</td>
<td>-.009</td>
</tr>
<tr>
<td></td>
<td>(-0.94)</td>
<td>(-1.04)</td>
<td></td>
</tr>
<tr>
<td>Positive Trend of Sales</td>
<td>.012</td>
<td>.084</td>
<td>.066</td>
</tr>
<tr>
<td></td>
<td>(0.52)</td>
<td>(0.41)</td>
<td></td>
</tr>
<tr>
<td>Negative Trend of Sales</td>
<td>-.034</td>
<td>-.052</td>
<td>-.011</td>
</tr>
<tr>
<td></td>
<td>(-0.39)</td>
<td>(-0.08)</td>
<td></td>
</tr>
<tr>
<td>Average Stock Market Return</td>
<td>.001</td>
<td>.052</td>
<td>.070</td>
</tr>
<tr>
<td></td>
<td>(0.38)</td>
<td>(0.50)</td>
<td></td>
</tr>
<tr>
<td>Stock Market Variability</td>
<td>1.167</td>
<td>-.009</td>
<td>-.008</td>
</tr>
<tr>
<td></td>
<td>(-1.50)</td>
<td>(-1.38)</td>
<td></td>
</tr>
</tbody>
</table>

* The two flexible compensation dummies are multiplied by the debt to assets ratio, as in Table 3. The means of the interacted variables are, respectively, .018 and .034.

Note: t statistics are shown in parentheses. The mean of the dependent variable, Δ long term debt, is .010. The R-square of the two OLS regressions are, respectively .41 and .43. Both regressions contain also two digit industry dummies and year dummies.
<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>MEANS (N = 134)</th>
<th>OLS</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit Sharing Dummy *Lagged Debt/Assets</td>
<td>0.012 (0.26)</td>
<td>-0.032 (-0.24)</td>
<td>-0.050 (-0.03)</td>
</tr>
<tr>
<td>Lump Sum Bonus Dummy *Lagged Debt/Assets</td>
<td>0.022 (1.33)</td>
<td>0.124 (1.73)</td>
<td>-0.098 (-0.24)</td>
</tr>
<tr>
<td>Lagged Debt to Assets Ratio</td>
<td>0.166 (-3.11)</td>
<td>-0.287 (-1.73)</td>
<td>-0.830 (-1.73)</td>
</tr>
<tr>
<td>Base Wage / Operating Income</td>
<td>0.335 (0.20)</td>
<td>0.002 (-0.50)</td>
<td>-0.016 (-0.50)</td>
</tr>
<tr>
<td>Retained Earnings / Total Assets</td>
<td>0.362 (1.05)</td>
<td>0.055 (1.00)</td>
<td>-0.171 (-1.00)</td>
</tr>
<tr>
<td>Operating Income / Total Assets</td>
<td>0.151 (-3.65)</td>
<td>-0.350 (-0.82)</td>
<td>-0.240 (-0.82)</td>
</tr>
<tr>
<td>Plant &amp; Equipment / Total Assets</td>
<td>0.429 (0.78)</td>
<td>0.061 (0.20)</td>
<td>0.020 (0.20)</td>
</tr>
<tr>
<td>Inventories / Total Assets</td>
<td>0.180 (0.16)</td>
<td>0.039 (-0.10)</td>
<td>-0.061 (-0.10)</td>
</tr>
<tr>
<td>Cash &amp; Receivables / Total Assets</td>
<td>0.240 (-1.10)</td>
<td>-0.107 (-0.80)</td>
<td>-0.153 (-0.80)</td>
</tr>
<tr>
<td>Other Assets / Total Assets</td>
<td>0.202 (0.14)</td>
<td>0.031 (0.34)</td>
<td>0.144 (0.34)</td>
</tr>
<tr>
<td>% Growth of Sales</td>
<td>0.089 (3.35)</td>
<td>0.186 (1.93)</td>
<td>0.144 (1.93)</td>
</tr>
<tr>
<td>Positive Shock to Sales</td>
<td>0.387 (0.00)</td>
<td>-0.000 (0.11)</td>
<td>0.003 (0.11)</td>
</tr>
<tr>
<td>Negative Shock to Sales</td>
<td>-0.469 (0.14)</td>
<td>0.001 (0.38)</td>
<td>-0.06 (0.38)</td>
</tr>
<tr>
<td>Positive Trend of Sales</td>
<td>0.012 (-1.04)</td>
<td>-0.193 (-0.29)</td>
<td>-0.163 (-0.29)</td>
</tr>
<tr>
<td>Negative Trend of Sales</td>
<td>-0.034 (1.83)</td>
<td>0.305 (0.12)</td>
<td>0.038 (0.12)</td>
</tr>
<tr>
<td>Average Stock Market Return</td>
<td>-0.000 (-0.33)</td>
<td>-0.060 (-0.36)</td>
<td>-0.082 (-0.36)</td>
</tr>
<tr>
<td>Stock Market Variability</td>
<td>1.080 (-3.49)</td>
<td>-0.021 (-1.88)</td>
<td>-0.022 (-1.88)</td>
</tr>
</tbody>
</table>

Note: t statistics are shown in parentheses. The mean of the dependent variable, Δ long term debt, is -0.001. The R-square of the OLS regression is 0.66; Both regressions contain also two-digit industry dummies and year dummies.
TABLE 8: DETERMINANTS OF THE PROBABILITY OF INTRODUCING A FLEXIBLE COMPENSATION SYSTEM

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>MEANS</th>
<th>LOGIT ON PROFIT SHARING</th>
<th>LOGIT ON LUMP SUM BONUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagged Debt to Assets Ratio</td>
<td>.14</td>
<td>.15</td>
<td>3.902</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(1.87)</td>
</tr>
<tr>
<td># of Workers</td>
<td>20.78</td>
<td>15.92</td>
<td>.007</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(1.40)</td>
</tr>
<tr>
<td>Average Firm Wage / Average Ind. Wage</td>
<td>1.32</td>
<td>1.28</td>
<td>3.737</td>
</tr>
<tr>
<td>Median Age of Workers in Ind.</td>
<td>36.85</td>
<td>37.03</td>
<td>.097</td>
</tr>
<tr>
<td>Stock Market Variability</td>
<td>1.31</td>
<td>1.24</td>
<td>.016</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.09)</td>
</tr>
<tr>
<td>Average Stock Market Return</td>
<td>.00</td>
<td>.00</td>
<td>6.050</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.84)</td>
</tr>
<tr>
<td>Positive Shock to Sales</td>
<td>.42</td>
<td>.40</td>
<td>-.225</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td>.01</td>
<td>5.345</td>
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<td>Positive Shock to Employment</td>
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<td>Unemployment Rate in the contr. month</td>
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</tr>
<tr>
<td></td>
<td></td>
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<td>(-1.65)</td>
</tr>
</tbody>
</table>

Note: t statistics are shown in parentheses. The sample sizes in the two LOGIT regressions are respectively 111 and 153, while the means of the dependent variables are .17 and .28. For a more general analysis of the determinants of the probabilities of lump sum bonuses see Chapter 1.
<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>MEANS (N = 909)</th>
<th>OLS</th>
<th>IV</th>
</tr>
</thead>
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<tr>
<td>Fraction of DC Plans</td>
<td>.050</td>
<td>.061 (2.42)</td>
<td>.297 (1.12)</td>
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<td>*Lagged Debt/Assets</td>
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<td>(-.456) (-4.69)</td>
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<td>Lagged Debt to Assets Ratio</td>
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<td>% Growth of Sales</td>
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<td>.049 (4.60)</td>
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Note: t statistics are shown in parentheses. The dependent variable, Δ long term debt, has a mean equal to -.003. The R-square of the OLS regression is .18, while the first stage R-square of the IV regression is .17 for the interaction term and .54 for the debt to assets ratio. Both regressions contain also two digit industry dummies.
II.2 A theoretical model of the relation between flexible compensation systems and debt issuance

Consider an entrepreneur who owns the patent for an investment project but does not have the initial capital to finance it. Suppose that the output $Q$ of the investment project is distributed according to

1) $Q \sim f(Q|\rho) \quad Q \in [Q_L, Q_H]$

where increases in the parameter $\rho$ correspond to mean preserving spreads of the distribution $f$. Let $D$ be the amount of debt that the entrepreneur borrows from outside sources and assume that the project also requires a fixed amount of labor. The model described in this section discusses the interaction between the level of debt financing and the choice concerning the compensation system—profit sharing or fixed wage—under which labor is hired.

Workers are assumed to have no bargaining power in contracting compensation. Their objective function depends only on compensation and it is assumed to have Constant Relative Risk Aversion properties:

2) $U(w) = w^h$

Let $\bar{w}$ indicate the exogenous level of the reservation wage; then, the reservation utility is

---

37 This is a one period static model. The issuance of debt is then equal to the total level of debt.
38 Note that $w$ is constrained to be smaller than $E(Q|\rho)$, otherwise no investment project would be undertaken. Further restrictions on $w$ will be introduced and discussed below.
3) \( \bar{U} = U(\bar{w}) = (\bar{w})^h \)

\( h \) is a crucial parameter in what follows because it summarizes workers' risk aversion; in fact, \( 1-h \) is the coefficient of relative risk aversion so that a lower \( h \) implies the workers' increasing dislike of compensation fluctuations.

The entrepreneur can choose between the following two compensation systems:

- the Fixed Wage System (denoted by \( W \) in what follows) is a system in which workers receive a wage \( w \) that is fixed before the realization of output and hence is independent of firm's performance; given the assumption that the entrepreneur has complete bargaining power, the wage under this system is \(^{39}\)

\[ \]

Let \( V(Q,w) \) be the objective function of the entrepreneur (to be characterized later); the assumption that workers have no bargaining power implies that the outcome of the contract described by equation (3) is the solution to the following maximization problem:

\[ \max_{\mu,\rho} E[V(Q,w)|\rho] + \rho E[U(w)-\bar{U}|\rho] \]

An alternative important characterization of a fixed wage system is

\[ \max_{\mu,\rho} E[V(Q,w)|\rho] + \lambda E[U(w)-\bar{U}|\rho] \]

Here workers have some bargaining power, denoted by \( \lambda \), and they share rents with the entrepreneur accordingly. Hence, shocks to the expected size of rents affect the wage that is fixed ex ante by the contract. On the contrary, in the case of problem (a), the contracted wage is always at the reservation level. The assumption (b) complicates considerably the analysis that follows but might have interesting additional implications. It will be left for future research, although I shall point out along the way the cases in which its consideration might be relevant.
4) \( w = \bar{w} \)

- The Profit Sharing System (denoted by \( P \) in what follows) is a system in which workers receive a fraction \( b \) of output so that their compensation depends on the firm's performance \(^40\); in order for the workers to accept this compensation system, their expected utility must be at least as high as their reservation utility, hence

5) \( E((bQ)^h | \rho) = (\bar{w})^h \implies b = \frac{\bar{w}}{[E(Q^h | \rho)]^{1/h}} \)

Note that the parameter of mean preserving spread \( \rho \) (uncertainty from now on) is known by the parties; under the fixed wage system the wage \( w \) is not affected by \( \rho \), while under the profit sharing system the fraction \( b \) and hence the expected compensation level \( bE(Q | \rho) \) is an increasing function of \( \rho \) because workers have to be compensated for the risk that they are taking.

The choice between these two compensation systems is strictly linked to the financial decision made by the entrepreneur. The link is created by the existence of different default risks under the fixed wage system and under the profit sharing system. Financial markets take this difference into account and behave accordingly. The choice of compensation system is then relevant because, by affecting the probability of bankruptcy, it affects the price of debt. In order to describe a framework in which this is true, I will proceed in two steps.

\(^40\) The absence of a constant in the linear compensation schedule is another restrictive assumption I plan to remove in future research; its implications are certainly important in what follows.
I will first characterize the difference between the debt pricing schedules that the firm faces under the two compensation systems for a given level of debt; this analysis will show that the firm can obtain a financial gain through the introduction of profit sharing. The second step will be to consider the labor market cost of profit sharing, related to the risk premium that has to be paid to workers, and to show, for different values of debt, under what conditions the benefit exceeds the cost and the value of the firm is maximized ceteris paribus by the introduction of profit sharing.

II.2.1 COST OF DEBT AND COMPENSATION SYSTEM

Assume for simplicity, a zero riskless interest rate. For each amount of debt D that the entrepreneur wants to borrow, she/he faces two prices imposed by the financial market: a price $R^w$ is charged if a fixed wage system is adopted while a price $R^p$ is charged in the case of a profit sharing system.

A preliminary restriction on the two price schedules is determined by the fact that, in order for the project to be undertaken, its expected return must be larger, under both compensation systems, than the sum of the expected claims on it; hence

6)  $E(Q|\rho) > w + R^w$

7)  $E(Q|\rho) > bE(Q|\rho) + R^p \implies E(Q|\rho) > \frac{R^p}{1 - b}$

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41 In what follows the price of debt will always include the repayment of the principal.
In other words, the firm cannot be expected to go bankrupt, although there might be a positive probability of bankruptcy. More precisely, bankruptcy occurs when the actual output realization is not enough to pay the wage and the cost of debt:

8) \( Q_L < Q < w + R^w \quad \longrightarrow \quad \text{bankruptcy under the wage system} \)

9) \( Q_L < Q < \frac{R^p}{1-b} \quad \longrightarrow \quad \text{bankruptcy under the sharing system} \)

Denoting with \( F \) the cumulative distribution of output, the probabilities of bankruptcy under the two compensation systems are

10) \( p^W = F(w + R^W) \)

11) \( p^P = F(\frac{R^P}{1-b}) \)

In order to simplify the analysis, I further assume that workers have priority over debt holders in case of bankruptcy and that the reservation wage is not larger than the minimum of the support of the output distribution, so that

12) \( w = \bar{w} \leq Q_L \)

These fairly restrictive assumptions imply that workers do not care if the firm goes bankrupt because they receive the compensation they are entitled to anyway. Furthermore, given that in all states of nature the firm can pay its workers, bankruptcy occurs only when the entrepreneur cannot pay back debt holders\(^{42}\). Finally, note that, by construction,

\(^{42}\) This is a third restrictive assumption that I plan to remove in future research. Without this assumption, workers face a risk also under the fixed wage system; a risk that shares some of the features of the
under the profit sharing system, the level of workers' compensation alone cannot cause bankruptcy since it is equal to a fraction of output realizations.

Let's now consider the debt pricing rule if the entrepreneur chooses the fixed wage system. Assume that potential debt holders are risk neutral and that competition among them enforces a zero expected profit constraint. If the probability of bankruptcy is zero, the price of debt is

13) \( R^W = D \) if \( Q_L > w + R^W \)

A more interesting situation occurs when the probability of bankruptcy is positive. In this case, potential debt holders anticipate that there will be external drains of cash away from the firm associated with formal bankruptcy proceedings (see footnote 3 in this chapter). Furthermore they anticipate that when the firm goes bankrupt they will only receive what is left of output after workers have been fully compensated and after all bankruptcy costs have been paid. Let \( C \) indicate these costs; the debt pricing rule that incorporates the anticipations of potential debt holders is

14) \( R^W[1-F(R^W+w|\rho)] + E(Q-w-C|Q<R^W+w)F(R^W+w|\rho) = D \)

\[ \implies R^W = g^W(D) \text{ if } Q_L < w + R^W \]

employment risk that is usually associated, in economic models, with rigid wage systems. Hence, removing this assumption would be a way to introduce the consideration of employment issues, and in particular to consider the existence of a trade off between employment flexibility and compensation flexibility; a shift to a profit sharing system, in fact, increases compensation fluctuations but reduces employment fluctuations.
The equation says that, the amount of debt borrowed by the firm must be equal to the expected repayment to debt holders. The expected repayment is the sum of what debt holders get in case of no bankruptcy times the probability of no bankruptcy, plus the expectation of what is left for them in case of bankruptcy times the probability of this event. Note, that (14) becomes equal to (13) when the probability of bankruptcy is zero.

Under plausible assumptions about the distribution of output, $R^W$ is an increasing convex function of $D^{43}$. The convexity in $D$ is caused by the fact that, given $w$, borrowing implies a higher bankruptcy probability; hence, $R^W$ grows with $D$ not just because of the larger principal, as in equation (13), but also because debt holders incorporate in the price the fact that bankruptcy is more likely. When inequality (6) is violated the firm incurs credit rationing. No one is willing to lend a sum $D$ to the firm if the price $R^N$ that incorporates the expected effects of bankruptcy is so high as to cause bankruptcy in expectation. Given that greater uncertainty, larger bankruptcy costs and larger wages are all factors that increases $R^W$ for a given $D$ and might even cause credit rationing, an entrepreneur facing any of these three factors might be interested in solutions aimed at reducing the bankruptcy probability and hence the cost of debt.

The introduction of a profit sharing system offers to the entrepreneur the opportunity of reducing ceteris paribus the probability of bankruptcy and the cost of debt financing. The debt pricing rule

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43 The proof of this result is in the Appendix A.
under this alternative compensation system is given by

\[ R^p \left[ 1 - F\left( \frac{R^p}{1-b} \mid \rho \right) \right] + E((1-b)Q-C|Q<\frac{R^p}{1-b})F\left( \frac{R^p}{1-b} \mid \rho \right) = D \]

\[ \implies R^p = g^p(D) \quad \text{if} \quad Q_L < \frac{R^p}{1-b} \]

where \( b \) is the profit sharing parameter, derived in equation (5), that makes workers indifferent between the two compensation systems. Also in this case, if the probability of bankruptcy is zero, the debt pricing rule collapses to

\[ R^p = D \quad \text{if} \quad Q_L > \frac{R^p}{1-b} \]

The non-linearity of the two debt pricing rules (14) and (15) and of the workers' indifference condition (5) makes it difficult to compare analytically \( R^w \) and \( R^p \) as functions of debt, uncertainty, workers risk aversion and bankruptcy costs. The analysis is then performed with the help of numerical solutions.

Figure 1, in the following page, describes the behavior of the two debt pricing rules as a function of uncertainty for four different combinations of bankruptcy costs and workers risk aversion. The distribution \( f \) is assumed to be a transformation of a symmetric Beta distribution; the negative of the parameter characterizing the Beta distribution is the index of mean preserving spread. When the index is equal to -7 the distribution is a highly concentrated, bell shaped, symmetric function over the interval \((Q_L, Q_H)\). When the index is equal to -1 the distribution becomes uniform over the same interval. Appendix B describes the other assumptions and the technique used to solve the model; it also discusses the assumptions and the empirical basis on
FIG. 1: COST OF DEBT AND UNCERTAINTY
FIG. 2: COST OF DEBT AND UNCERTAINTY
which the values of the parameters have been chosen.

In all four panels of Figure 1 the price of debt under the fixed wage system (the schedule denoted with circles) is increasing and convex in uncertainty. It does not depend on workers risk aversion given that the wage is fixed at the reservation level for all values of $\rho$. On the other hand, it is sensitive to the level of bankruptcy costs. When these costs go from $\approx 3\%$ to $\approx 15\%$ of the firm's value, the interest rate at the highest uncertainty level approximately doubles.

The price of debt under the profit sharing system (the schedule denoted with triangles), does not change across the panels of Figure 1. The reason is twofold. First, the specific setting of parameter values is such that under the profit sharing system the probability of bankruptcy becomes equal to zero\textsuperscript{44}. Hence, by choosing a profit sharing system the entrepreneur eliminates the reason for which debt is priced above the risk less interest rate, so that the pricing rule collapses to equation (15); in this case bankruptcy costs become clearly irrelevant. Second, also risk aversion is irrelevant because of the elimination of any bankruptcy risk. This point can be better understood by looking at Figure 2.

In Figure 2 the parameters are set in a way such that there is a

\textsuperscript{44} Given a wage equal to 600 the parameter $b$ is sufficiently close to .6, despite uncertainty and workers risk aversion; hence, the no-bankruptcy condition: $Q_i \geq R_i^+/(1-b)$, turns out to be always satisfied for $D = 100$. A much higher debt to wage ratio is needed in order to have bankruptcy under profit sharing; such a situation is shown in figure 2 discussed below.
positive probability of bankruptcy under a profit sharing system. The corresponding price of debt is consequently no longer flat and equal to D, but it increases with uncertainty. Likewise under the fixed wage system, the effect of uncertainty on $R^p$ is stronger the larger the bankruptcy costs. In addition, risk aversion is also relevant for the $R^p$ schedule because the higher the uncertainty, the higher the risk premium that is required by workers to be indifferent between the two compensation systems. Hence, when uncertainty increases, workers receive a larger fraction of output and, for given D, this raises the already positive probability of bankruptcy. So the existence of a positive probability of bankruptcy under profit sharing makes the correspondent price of debt sensitive not only to bankruptcy costs, as for the fixed wage system, but also to workers' risk aversion.

In summary, the message to be taken from Figures 1 and 2 is that the price of debt faced by a profit sharing firm is smaller than the price of debt faced by a fixed wage firm. Furthermore, although the cost of debt grows with uncertainty under both systems, the spread between the two price schedules becomes increasingly favorable to profit sharing when uncertainty increases. The reason for this is that the adoption of profit sharing reduces or even eliminates the probability of bankruptcy and the expected size of its consequences for debt holders.

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45 More precisely the debt to wage ratio has been raised in order to increase the probability of bankruptcy under the wage system; also the range of output fluctuations and the parameter h defining risk aversion have been raised in order to make the profit sharing parameter more sensitive to uncertainty.
II.2.2 DEBT FINANCING, PROFIT SHARING AND THE VALUE OF THE FIRM

If, on the one hand, the introduction of profit sharing has the advantage of reducing the price of debt, on the other hand it has a cost that can, in principle, be high enough to make the traditional fixed wage system altogether preferable. This cost is represented by the fact that, independently from any financial market consideration, in order for the workers to accept a flexible compensation, instead of a fixed wage, a risk premium has to be paid to them\footnote{Note that the focus here is on the direct effect of workers' compensation on the firm's value, not on the indirect effect through the cost of debt described in Figure 2.}. Given the absence of a

\[ \text{c) } \max_{w(Q)} E(V(Q,w(Q))|\rho) + \lambda E(U(w(Q))-U^*(\rho,\bar{U})|\rho) \]

Problem (c) says that the profit sharing outcome is a wage schedule $w(Q)$, dependent on output, but such that the workers obtain in expectation the same level of utility they would get under the fixed wage system at the larger level of uncertainty. The risk premium, in this case, is not related to the fixed wage that workers were receiving before the increase in uncertainty, but to the fixed wage workers would get at the new level of uncertainty.

This situation captures the characteristics of a concessionary environments in which a shock to expected rents forces workers to accept a lower wage under the fixed wage system; this is in fact the kind of situation where many profit sharing contracts have initially appeared in the US (for example Ford, GM, Chrysler). The extension of the model in this direction might show that in such a concessionary environment a profit sharing contract allows the firm to lose less, or gain more, if the same concession is taken by workers in a profit sharing form as opposed to a fixed wage form; from the workers' point of view, they receive less than in the past under both compensation systems, but the
constant in the linear sharing rule assumed in equation (5), this risk premium takes the form of a larger value of the parameter b; large enough to make workers indifferent between the two compensation systems. This means that the larger the uncertainty, the larger the expected compensation package that has to be promised to workers. Hence, the expected value of the firm is ceteris paribus necessarily smaller.

In other words, in order to decide whether to introduce a profit sharing system or not, the entrepreneur compares the expected gain in the financial market to the expected cost on the labor market, and makes the choice that ensures the highest expected firm’s value. The next step is then to compute the expected value of the firm under the two compensation systems. Recalling that in case of bankruptcy the value of the firm is zero because debt holders are entitled to all what is left after workers have been paid, the expected value of the investment project under the fixed wage system is

\[ V^w = E(Q-w-R^w|Q\geq w + R^w)[1-F(R^w+w|\rho)] \]

\[ = E(Q-w) - CF(R^w+w|\rho) - D \]

\( V^w \) is the expected value of what is left after paying workers and debt holders in case of no bankruptcy, times the probability of this event. In other words, this is the total dividend that the project is expected to pay to the entrepreneur. The analogous expected value under the profit sharing system is

profit sharing system pays them a risk premium with respect to the hypothetical fixed wage contract that would be signed in the same concessionary environment.
18) \[ V^P = E((1-b)Q - R^P_{\frac{R^P_{1-b}}{1-b}})[1-F(\frac{R^P_{1-b}}{1-b}|\rho)] \]
\[ = E((1-b)Q) - CF(\frac{R^P_{1-b}}{1-b}|\rho) - D \]

where \( b \) is again the profit sharing parameter, derived in equation 5), that makes workers indifferent between the two systems. The difference between the two values can then be expressed as

19) \[ V^P - V^H = [W - E(bQ)] + [CF(R^H + w|\rho) - CF(\frac{R^P_{1-b}}{1-b}|\rho)] \]

In equation (19) the cost and the benefit of the introduction of profit sharing are shown explicitly: the first expression in brackets represent the risk premium that has to be paid to workers; on the other hand, the second expression in brackets represents the saving on expected bankruptcy costs generated by the fact that under profit sharing the probability of bankruptcy is smaller, if not zero.

The numerical comparison between (17) and (18) is shown in Figures 3, 4, 5 and 6. Each figure is drawn for a different combination of bankruptcy costs and workers' risk aversion, while the panels in each figure are drawn for different degrees of leverage. The basic parameter setting is the one in Figure 1 - see the Appendix B - and implies a zero probability of bankruptcy under the profit sharing system\(^{47}\).

Consider Figure 3, in which both the cost of bankruptcy and workers' risk aversion are assumed to be low. In the panel 3a debt is zero; the expected value of the firm under the fixed wage system (the

\(^{47}\) Note however that the results are qualitatively identical to those obtained with the less realistic parameters of Figure 2, in which the probability of bankruptcy is also positive under profit sharing.

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schedule denoted with circles) is independent of uncertainty and always equal to the difference between expected output and the fixed wage, i.e. 400.

On the other hand, under profit sharing, given that debt is zero, there is no gain to be obtained on financial markets; hence, the shape of the \( V^p \) schedule (denoted with triangles) shows only the effect of the cost of this compensation system, namely the risk premium to be paid to workers. The value of the profit sharing firm is always smaller and it decreases with uncertainty because the risk premium increases.

Panels 3b, 3d and 3c are drawn for higher degrees of leverage. The higher the leverage the higher is the probability of bankruptcy under the fixed wage system and consequently the \( V^W \) schedule as well becomes negatively affected by uncertainty. Furthermore, at positive leverage, the introduction of profit sharing not only has a cost, but it also delivers a gain because it reduces the probability of bankruptcy and the cost of debt financing. In panel 3b the cost is still larger than the gain, and the entrepreneur prefers the fixed wage system at any level of uncertainty. In panel 3c leverage is high enough to make profit sharing preferable if uncertainty is sufficiently high. Finally, in the last panel, drawn for \( D = 300 \), profit sharing is always preferable except for the highest level of uncertainty when the risk premium that has to be paid to workers exceeds the benefit obtained in the financial market.

In Figure 4 bankruptcy costs are at a high level and this creates conditions that are more favorable to the introduction of profit sharing. Here we see that a level of debt equal to 200 (panel 4b) is enough to make profit sharing preferable if uncertainty is sufficiently
(low bankruptcy cost - low risk aversion)

FIG. 3a: zero leverage - debt = 0

FIG. 3b: low leverage - debt = 100

FIG. 3c: medium leverage - debt = 200

FIG. 3d: high leverage - debt = 300

FIG. 3: FIRM'S VALUE, UNCERTAINTY AND LEVERAGE
(high bankruptcy cost - low risk aversion)

FIG. 4a: Zero leverage - debt = 0

FIG. 4b: Low leverage - debt = 100

FIG. 4c: Medium leverage - debt = 200

FIG. 4d: High leverage - debt = 300

FIG. 4: FIRM'S VALUE, UNCERTAINTY AND LEVERAGE
(low bankruptcy cost - high risk aversion)

FIG. 5: FIRM'S VALUE, UNCERTAINTY AND LEVERAGE
(high bankruptcy cost - high risk aversion)

FIG. 6: FIRM'S VALUE, UNCERTAINTY AND LEVERAGE
high, while in Figure 3 this occurs only at higher degrees of leverage. Furthermore even at the highest level of uncertainty (\(\rho = -1\)) the risk premium paid to workers does not offset the saving on the cost of debt. Figure 5, on the contrary, describes conditions that are less favorable to the introduction of profit sharing, namely low bankruptcy costs and high risk aversion. Here we see that even at high degrees of leverage the expected value under profit sharing is smaller and higher uncertainty lowers the value even more given the high level of workers risk aversion. At such a large level of risk aversion high bankruptcy costs are a necessary condition for profit sharing, to be preferable, as is shown in Figure 6.

Altogether Figures 3, 4, 5, and 6 seem to indicate that a profit sharing compensation system is not always preferable to a fixed wage compensation system, despite the more favorable debt pricing schedule faced \(ceteris paribus\) by a firm under profit sharing. The model, however, provides some indications concerning the factors that increase the likelihood of the introduction of profit sharing and its relation to debt issuance:

a) Higher bankruptcy costs increase the desirability of a compensation system that reduces the probability of bankruptcy and hence the cost of debt.

b) Higher workers' risk aversion increases the risk premium that has to be paid to workers in order for them to accept a flexible compensation package; hence it should increase the cost of introducing a profit sharing system.

c) Uncertainty, \(ceteris paribus\), has an ambiguous effect: on the one
hand it increases the risk of bankruptcy and the size of its expected consequences and hence makes profit sharing more desirable; on the other hand it increases the risk premium that has to be paid to workers and hence makes profit sharing less desirable.

d) Finally, and perhaps more interestingly, when a firm's leverage is higher the conditions under which profit sharing is preferable are more easily met. In other words, in a cross section of firms that differ in their debt to assets ratios, we should observe higher leverage associated with the introduction of profit sharing. Furthermore, controlling for the level of debt, we should find evidence suggesting that highly leveraged firms that shift to profit sharing face a lower cost of issuing new debt; hence, among these firms we should observe ceteris paribus a larger issuance of new debt. These indications are consistent with the econometrics results obtained in the first section of this chapter.

Conclusions

The focus in this chapter has been on the joint consideration of two decision processes characterizing a firm: the determination of the desired amount of debt on the financial side and the determination of the compensation package on the labor market side. The existence of an interaction between these two decision processes has been shown to be supported by the data and to have theoretical justifications. The outcome of this interaction consists in the fact that the introduction of profit sharing systems is accompanied by a larger issuance of new debt, controlling for the level of outstanding debt; furthermore the
level of outstanding debt seems to positively affect the probability of introducing profit sharing.

The implications of these findings might go beyond the understanding of flexible compensation systems as risk sharing devices. If profit sharing labor contracts allow current stock holders to issue more debt without increasing the overall ratio of fixed versus residual claims within the firm, other financial decisions might also be affected; for example the issuance of new shares. One of the costs of equity financing for current stock holders is the loss of control of the firm: a smaller share of the value of the firm accrues to current stock holders, and, perhaps more importantly, the voting power transferred to possibly unfriendly hands might influence future decisions and might facilitate hostile takeovers. In those situations in which this is a relevant cost, the combination of debt and profit sharing might become a dominant strategy inasmuch as it produces the same effects as issuing new shares without voting rights.

The extension of the analysis contained in this chapter to the consideration of the interactions between compensation systems and equity financing at both the theoretical and empirical level is on my agenda for future research. However, also in the absence, at this stage, of a clear understanding of these additional interactions, one set of issues can nevertheless be expected to bear some relevance in the light of the above considerations: what happens when workers are asked to share risk without sharing decisions? This question motivates the next chapter.
Appendix

A) PROPERTIES OF THE DEBT PRICING RULE UNDER THE WAGE SYSTEM

Under the wage system the cost of debt \( R^w \) is given by the solution to equation (14) in the text, i.e.

A1) \[ R^w[1-F(R^w+w)] + E(Q-w-C|Q<R^w+w)F(R^w+w) = D \]

This equation implies that \( R^w \) is an increasing convex function of the amount of debt borrowed by the firm. In fact:

A2) \[ \frac{\partial R^w}{\partial D} = \left[ 1 - F(R^w+w) - R^w f(R^w+w) + (R^w - C)f(R^w+w) \right]^{-1} \]

A3) \[ \frac{\partial R^w}{\partial D} = \left[ 1 - F(R^w+w) - Cf(R^w+w) \right]^{-1} \]

When \( R^w + w < Q_L \) the cumulative distribution \( F \) and the density function \( f \) are both equal to zero and the derivative is equal to 1. This is the case of no bankruptcy risk, in which \( R^w = D \). When \( R^w + w \) increases above \( Q_L \) the cumulative distribution and the density becomes positive and the term in brackets decreases; the derivative remains initially positive and becomes larger than one. When

A4) \[ 1 - F(R^w+w) + Cf(R^w+w) \]

the derivative becomes infinite and the firm incurs credit rationing. The convexity of the debt pricing rule is shown by the sign of the second derivative, given by

A5) \[ \frac{\partial R^w}{\partial D} = \left[ 1 - F(R^w+w) - Cf(R^w+w) \right]^{-2} \left[ f(R^w+w) + C \frac{\partial f(R^w+w)}{\partial R^w} \right] \]

This second derivative is positive if

A6) \[ \frac{\partial f(R^w+w)}{\partial R^w} > 0 \]

This condition is satisfied if the distribution \( f \) is assumed to be
symmetric and bell shaped over the support \((Q_L, Q_H)\) and

A7) \[ R_{W+W} < E(Q) \]

A7) is certainly true because the expected return of the project has to be larger than the sum of the claims on it, as required by the inequality (6) in the text, otherwise the project would not be undertaken.

B) THE NUMERICAL SOLUTION OF THE MODEL

The numerical solution of the model is computed in the following way. The output \(Q\) of the investment process (see eq. 1 in the text) is specified as

B1) \[ Q = Q_L + \eta \quad \text{where} \quad \eta \in (0,S) \quad \text{and} \quad S = Q_H - Q_L \]

\(\eta\) is a random component and the parameters \(Q_H\) and \(Q_L\) delimit the range of output fluctuations. The distribution of the random component \(\eta\) is assumed to be a transformation of a symmetric Beta distribution. More precisely, define

B2) \[ \hat{\eta} = \frac{\eta}{S} \quad \hat{\eta} \in (0,1) \]

this normalized error component is assumed to be distributed as a symmetric Beta distribution;

B3) \[ \hat{\eta} \sim g(\eta | \beta, \beta) = \frac{\hat{\eta}^{\beta-1}(1-\hat{\eta})^{\beta-1}}{B(\beta,\beta)} \int_0^1 (\hat{\eta})^{\beta-1}(1-\hat{\eta})^{\beta-1} d\eta \]

where \(B(\beta,\beta)\) is the Beta function.\(^{48}\) The equality of the two parameters of the distribution ensures its symmetry. The negative of the parameter \(\beta\) is the index of mean preserving spreads of the symmetric Beta distribution.

\(^{48}\) See Mood and Graybill (1974).
All the other variables of the model are normalized in the same way, i.e. they are divided by the range of output fluctuations $S$. In what follows the normalized variables are denoted with a $\hat{\cdot}$. The model is solved in its normalized form in order to exploit the built-in cumulative Beta distribution function provided by the software. More precisely, denoting with $G(\tau|\beta,\beta)$ the cumulative Beta distribution evaluated at $\tau$, the equation (14) in section II.2.1, normalized, by $S$ can be written as

$$B4) \quad \hat{R}^w[1-G(\hat{R}^w+\hat{\omega}-\hat{Q}_L|\beta,\beta)] + \int_0^{\hat{\eta}} \hat{g}(\hat{\eta}|\beta,\beta) d\hat{\eta} + (Q_L - \hat{\omega} - \hat{Q}) G(\hat{R}^w+\hat{\omega}-\hat{Q}_L) = \hat{B}$$

Exploiting the property of the Beta distribution according to which

$$B5) \quad \int_0^{\hat{\eta}} \hat{g}(\hat{\eta}|\beta,\beta) d\hat{\eta} = \int_0^{\hat{\eta}} \frac{(\hat{\eta})^{\beta-1}(1-\hat{\eta})^{\beta-1}}{B(\beta,\beta)} d\hat{\eta} = \frac{1}{2} \int_0^{\hat{\eta}} \frac{(\hat{\eta})^{\beta}(1-\hat{\eta})^{\beta-1}}{B(\beta+1,\beta)} d\hat{\eta}$$

$$= \frac{1}{2} \int_0^{\hat{\eta}} g(\hat{\eta}|\beta+1,\beta) d\hat{\eta} = \frac{1}{2} G(\hat{R}^w+\hat{\omega}-\hat{Q}_L|\beta+1,\beta)$$

the computer solves numerically for the value of $\hat{R}^w$ that satisfies

$$B6) \quad \hat{R}^w[1-G(\hat{R}^w+\hat{\omega}-\hat{Q}_L|\beta,\beta)] + \frac{1}{2} G(\hat{R}^w+\hat{\omega}-\hat{Q}_L|\beta+1,\beta) + (Q_L - \hat{\omega} - \hat{Q}) G(\hat{R}^w+\hat{\omega}-\hat{Q}_L|\beta,\beta) = \hat{B}$$

given different combinations of the values of the parameters (see below for the criteria according to which these values have been chosen). Then $R^w = S\hat{R}^w$ is obtained.

Given the solution $\hat{R}^w$ obtained from (B6), the corresponding value of the firm is computed according to equation (17) in the text. The

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49 The software I used for the computations is Gauss, Version 2.0.
normalized version of that equation is

$$\hat{V}^W = \int_{\hat{R}^W + \hat{Q}_L}^1 \hat{\eta} g(\hat{\eta}|\beta, \beta) d\hat{\eta} + (\hat{Q}_L - \hat{\eta})G_{\hat{R}^W + \hat{Q}_L}^1 - G_{\hat{R}^W + \hat{Q}_L}^1$$

Again using the properties of the Beta distribution the computer solves

$$\hat{V}^W = \frac{1}{2} \left[ 1 - G_{\hat{R}^W + \hat{Q}_L}^1 - \hat{\eta} \right] + (\hat{Q}_L - \hat{\eta})G_{\hat{R}^W + \hat{Q}_L}^1 - G_{\hat{R}^W + \hat{Q}_L}^1$$

and then computes $V^W = S\hat{V}^W$.

In order to derive the debt pricing rule and the value of the firm under profit sharing, the sharing parameter $b$ has first to be determined. This is obtained by solving equation (5) in the text. Given the distributional assumptions described above, that equation can be written as

$$b = \frac{\bar{w}}{\left[ \int_0^1 (Q_L + S_{\hat{\eta}})^{h} (\hat{\eta})^{\beta-1} (1-\hat{\eta})^{\beta-1} d\hat{\eta} \right]^{1/h}} = \frac{\bar{w}}{\left[ \int_0^1 (Q_L + S_{\hat{\eta}})^{h} g(\hat{\eta}|\beta, \beta) d\hat{\eta} \right]^{1/h}}$$

Given $b$ from (B9), the computer evaluates the debt pricing rule described by equation (15) in the text. The normalized version of that equation is

$$\hat{P}^R \left[ 1 - G_{\frac{\hat{P}^R}{1-b} - \hat{Q}_L}^1 - \hat{\eta} \right] + (1-b) \frac{\hat{\eta} g(\hat{\eta}|\beta, \beta) d\hat{\eta}}{0} + ((1-b)\hat{Q}_L - \hat{\eta})G_{\frac{\hat{P}^R}{1-b} - \hat{Q}_L}^1 - \hat{\eta} = \hat{\eta}$$

and again using the properties of the Beta distribution the computer solves

$$\hat{P}^R \left[ 1 - G_{\frac{\hat{P}^R}{1-b} - \hat{Q}_L}^1 - \hat{\eta} \right] + \frac{1}{2} G_{\frac{\hat{P}^R}{1-b} - \hat{Q}_L}^1 \frac{\hat{\eta} g(\hat{\eta}|\beta+1, \beta) d\hat{\eta}}{0} + ((1-b)\hat{Q}_L - \hat{\eta})G_{\frac{\hat{P}^R}{1-b} - \hat{Q}_L}^1 - \hat{\eta} = \hat{\eta}$$

and then computes $R^P = S\hat{P}^R$.

Finally the value of the firm under profit sharing is computed on
the basis of equation (18) that, in normalized form, can be written as

\[ B12) \quad \hat{\theta}^p = (1-b) \int_{1-b}^{1} \hat{\eta} g(\hat{\eta} | \beta, \hat{\beta}) d\hat{\eta} + ((1-b) \hat{Q}_L - \hat{R}_L^p) \left[ 1 - C\left( \frac{\hat{R}_L}{1-b} - \hat{Q}_L | \beta, \beta \right) \right] \]

As for the other equations, the computer solves

\[ B13) \quad \hat{\theta}^p = (1-b) \frac{1}{2} \left[ 1 - G\left( \frac{\hat{R}_L}{1-b} - \hat{Q}_L | \beta + 1, \beta \right) \right] + ((1-b) \hat{Q}_L - \hat{R}_L^p) \left[ 1 - G\left( \frac{\hat{R}_L}{1-b} - \hat{Q}_L | \beta, \beta \right) \right] \]

and then computes \( V^p = S \hat{\theta}^p \).

In summary, following the steps described above, the computer evaluates \( R^p_L, R^p, V^p \) and \( V^p \) as functions of the parameters of the models. The basic simulation set up, used in the figures 1, 3, 4, 5 and 6, fixes the parameters \( Q_L, Q_H \) and \( w \), and then let the computer solve the above equations for different values of the other parameters, i.e. workers' risk aversion \( h \), bankruptcy costs \( C \), the parameter of mean preserving spread \( \beta \) and the level of debt \( D \).

The fixed parameters \( Q_L, Q_H \) and \( w \) are chosen in the following way.\(^{50}\) The expected value of output is normalized to 1000, while \( Q_H \) and \( Q_L \) are assumed to be respectively equal to 1400 and 600. Hence, the range of output fluctuations is 4/5 of the expected level of output. These numbers reproduce, approximately, the range of fluctuations around the mean of revenues before worker compensation and after other production costs in the sample of COMPSTAT firms on which the econometric analysis has been conducted.\(^{51}\) This is the budget measure that most closely

\(^{50}\) This is the basic simulation set up; Figure 2, in the text, is based on slightly different set up, described in the footnote 45.

\(^{51}\) The variable used to characterize Q is the sum of COMPSTAT items 13 (operating income before depreciation) and 42 (labor and related expenses) divided by item 6 (total assets). The mean in the sample is .56 while the minimum and the maximum are respectively .18 and 1.24. Hence the sample distribution is skewed, while I force it to be symmetric, and the range of fluctuations is proportionally slightly larger than what I assume. My conservative assumption is justified by the likelihood of outliers in the COMPUESTAT sample.
captures what $Q$ represents in the model.

The wage level is also chosen on the basis of the same sample of COMPUSTAT firms. In that sample the average labor costs are equal to almost 7/10 of the mean output $Q$ (as defined above). Given that these costs include also managerial and executive compensation while my analysis refers only to white and blue collar compensation, I assume, wages to account for a slightly smaller fraction of expected output, namely 6/10. Note that this assumption together with the assumption about $Q_L$ satisfies the condition according to which worker compensation alone cannot cause bankruptcy.

As far as bankruptcy costs are concerned, Warner (1977) estimates, for a sample of railway firms, these costs to be equal to 1% of the value of the firm. This is, however, an estimate of what he calls direct costs, i.e. "lawyers' and accountants' fees, other professional fees and the value of the managerial time spent in administering the bankruptcy." He does not estimate the indirect costs that include "lost sales, lost profits, and possibly the inability of the firm to obtain credit or to issue securities, except under especially onerous terms." He also quotes Baxter (1967) who estimates direct bankruptcy costs to be 20% of the firm's value; this high estimation was based on data that referred to personal bankruptcies and to dollar amounts of individual assets, i.e. assets that are much smaller than those of Warner's Railroad companies. The undisputable presence of relevant indirect bankruptcy costs suggest that Warner's 1% estimate is low from the point of view of my simulation set up, while Baxter's 20% estimate might be considered as an upper bound. I then distinguish between two levels of bankruptcy costs: the low level is chosen to be in the range of 3% of the value of the firm; the high level is instead chosen to be approximately 15% of the value of the firm.

Workers' risk aversion is defined by the parameter $h$ of the utility function. Low risk aversion is denoted, in the basic set up, by $h = .9$; this implies an almost linear utility function. High risk aversion is instead denoted by $h = .3$, that implies a more concave utility function.

The parameter of mean preserving spreads of the distribution, i.e.
$\beta$, is chosen to vary between 7 and 1. An increase in the spread of the distribution is denoted by a decrease of $\beta$. When $\beta = 7$ the distribution is a highly concentrated, bell shaped, symmetric distribution over the interval (0,1); when $\beta = 1$, the distribution becomes uniform over the same interval.

Finally, the four levels of debt for the four panels in figures 3, 4, 5 and 6 are chosen to describe the effect of different degrees of leverage within the range allowed by the inequality (6) in Section II.2.1; in order to satisfy that constraint, given the above assumptions about output and wages, debt cannot be larger than 400 and it actually has to be smaller in relation to uncertainty and the size of bankruptcy costs. So, the values used in the simulation are 0, 100, 200 and 300.
References


Blanchard, Olivier "Macroeconomic Implications of the New Form of Labor Contracts", comments prepared for the Wage Structure Conference, held at the Federal Reserve of Cleveland, November 1989


Warshawsky, Mark "Is there a Corporate Crisis? Another Look", Mimeo 1990

CHAPTER III

FLEXIBLE COMPENSATION, RISK SHARING AND THE INSURGENCE OF INDUSTRIAL RELATIONS CONFLICTS.

The Italian case

The most recent round of company level bargaining in Italy has been characterized by the increasing diffusion of compensation clauses according to which wages have been linked to different measures of firm's performance. Particularly striking, in the Italian context, is the recent appearance of contracts in which individual wages have been linked to company-wide economic indicators; unlike the U.S., where these contracts have been observed in the more distant past, in Italy they are a rather new phenomenon.

Along the lines suggested in the Introduction, these flexible compensation systems have a double nature: on the one hand, they may be interpreted as incentive devices introduced by firms that need to induce a coordinated effort among their workers and their units; on the other hand, they may be interpreted as risk sharing devices introduced by firms that face more uncertainty about the future or by firms for which the cost of uncertainty has increased. The absence, at this stage, of sufficiently informative data on the diffusion of flexible compensation systems in Italy prevents the testing of the implications of the two alternative views. The analysis contained in this chapter is,

1 See the Introduction to this thesis for some evidence on this phenomenon.
nevertheless, based on more qualitative, but not less informative, evidence deriving from interviews with managers and compensation experts.

Starting from ideas suggested in those interviews, this chapter focuses on the industrial relations implications of flexible compensation systems. Section III.1 describes the set of circumstances and the motivations of social actors that, in my opinion, have led to the recently increasing diffusion of gain sharing programs aimed at raising productivity. It is argued that these flexible compensation systems evolve from historical trends and do not represent a break point in those trends. On the contrary systems based on company wide economic indicators do not seem to evolve from the same trends. Section III.2 on the basis of the very limited available evidence, highlights some features of these contracts suggesting that a perception of greater uncertainty and the consequent need for flexibility might be important factors explaining their diffusion.

Section III.3 discusses this possibility starting with the consideration of the comments of two FIAT executives concerning the flexible compensation contracts recently signed by the Italian car company. A simple model is then constructed in order to clarify why conditions like the ones described by the two executives might explain the advantages of profit sharing rules for the company. The main goal of the model is, however, to highlight the industrial relations consequences of these rules; in particular the model shows that if risk and expected revenue are positively related across different investment projects, the introduction of profit sharing may create a conflict
between workers and management concerning the choice of investment projects. Section III.4 on the basis of this result argues that if the trend of bargaining outcomes points consistently toward compensation innovations aimed at making workers share part of the firm's risk, then an evolution to a different compensation system - and more generally to a different industrial relations system - may become a significant possibility. This may in fact be the case if trade unions begin to recognize the fact that firms need greater compensation flexibility and ask, in exchange for that, to take part in those managerial decisions concerning the risk to which workers' compensation is linked.

III.1 Trends in industrial relations and gain sharing systems based on production indicators

The end of the '70s and the early '80s in Italy have been a period of moderate productivity growth that forced many firms to rely on heavy restructuring and layoffs in order to regain competitiveness. One of the aspects that in the opinion of many employers needed some intervention was the internal compensation structure. If one of the functions of wage differentials within the firm were to create incentives and reward skills and effort, that function had almost completely been swamped by the egalitarian trend in compensation policies imposed by unions during the '70s and by the joint effects of inflation and lump sum COLA clauses. The strategy chosen by many employers to reverse the egalitarian trend was to use totally discretionary individual wage increases granted above the contractual base wage (superminimi). This strategy, although opposed by unions who were in this way losing control
of wage determination, was received favorably by highly skilled workers with strong positions in the market. The support of skilled workers and the increasing weakness of unions, unable to resist layoffs, favored the use of "superminimi". It was a feasible and effective way to recreate an incentive structure within the firm, to enhance productivity and to avoid the flight of better workers to other firms or to self employment.

The loss of control of compensation policies suffered by unions became even more dramatic in those cases in which employers, supported by their national union, refused to bargain at the local level on issues already discussed at the national or industry level, among which were wages. More generally, the industrial relations policy of many employers was to exclude trade unions as much as possible and to favor a direct relationship with individual workers.

Once the emergency was over and productivity growth had come back to satisfactory levels, the disadvantages of that kind of policy became evident. The recourse to "superminimi" began to run out of firms' control, giving rise to an explosion of individual claims concerning compensation policies; those claims were in fact nourished by the sudden breakdown of the customary compensation equilibria that had been smoothly evolving under the regime of the '70s. The consequent lack of stable rules and the need for continual readjustments started to lead firms into undesirable situations of anarchy in their compensation structure. Employers had to realize that among many disadvantages, trade unions had one merit: they were a well defined and well known counterpart, often predictable, and with which, in any case, it was possible to establish a relatively stable system of bargaining rules. In
addition, dealing with unions insured to some extent that agreements reached within the life of a certain contract were not repeatedly brought up for discussion again. In the mean time, the disruptive fragmentation of bargaining and claims promoted by COBAS (corporative trade unions) in the public sector convinced private employers of the danger of an excessive weakening of traditional national trade unions.

In this modified situation agreeing with the unions on gain sharing systems based on production indicators became a better instrument to create incentives and reward skills without worsening the industrial relations environment. In fact, this strategy offered employers an opportunity to re-establish a less antagonistic relationship with unions; furthermore, precisely the re-establishment of this relationship allowed stability, continuity and predictability in the internal compensation structure. Finally, gain sharing systems could be structured in ways that were in principle only slightly less flexible than the "superminimi", although certainly not as flexible.

On the labor side, the offer of going back to the bargaining table at the local level to discuss the introduction of wage components linked to production indicators found the unions essentially unprepared and standing on the defensive. On the one hand there was a tendency toward considering these compensation innovations as a threat to some of the traditional achievements of the labor movement. For example, also without considering the by then abandoned slogan of the 70s that claimed the wage to be an "independent variable", the gain sharing systems proposed by the firms were often incompatible with the solidarity principle according to which workers in the same contractual category
(inquadramento) should receive the same pay. Furthermore, gain sharing clauses often conflicted with the traditional principle according to which workers absent for justified reasons, like pregnant mothers, sick workers, labor representatives etc, should not suffer any pay reduction because of their status. Finally, if on the one hand employers were claiming that the innovations removed automatic wage increases that were very dangerous for the international competitiveness of Italian firms, for trade unions the problem was exactly the opposite: the innovations were making the wage depend on new automatic mechanisms that were welcomed by employers but that substantially limited the traditional union role.

On the other hand, rather than coming from a period of victories, trade unions had lost their capacity to control wage determination at the firm level. Hence, among union leaders a tendency opposite to the one mentioned in the previous paragraph gradually gained increasing support. According to this view, gain sharing systems based on production indicators were not seen as concessions but as the only feasible way to find a new role at the bargaining table. Support for this view was made stronger among union leaders by the necessity to recognize that skilled workers no longer accepted the old egalitarian compensation policies, and claimed that the recognition of productivity and effort had to be the basis for wage differentials; as noted above, these feelings were seen very favorably by firms. In such a situation the offer to bargain over gain sharing systems appeared to most union leaders as the only way to avoid being cut off by the convergence of interests between employers and highly qualified workers, while
allowing unions to still exert some influence on the structure of incentives and compensation within the firm.

III.2 Company wide economic indicators: the real innovation of the most recent contractual round

The scenario that was just described highlights the circumstances and the attitudes of the social actors that may explain the presence of gain sharing clauses based on production indicators as incentive devices. However, there are some aspects of the observed phenomenon that fail to fit nicely into the above framework and suggest the possibility of some other factors characterizing the recent bargaining round.

First of all, it should be noted that gain sharing clauses based on production indicators are not a new phenomenon in the history of Italian industrial relations. Systems of that kind were already present in the '60s. During the '70s, at the height of union strength, they were frozen into fixed components of the compensation package that still bore the name indicating their gain sharing origin, but in fact had lost any relation to productivity\(^2\). However, later, starting in the early '80s and not only in the most recent bargaining round, they appeared again in their original form of explicit incentive devices\(^3\).

Hence, this kind of gain sharing contract does not seem to be an innovative outcome of the recent contractual round. What is innovative

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\(^2\) The most notable example was the so called "premio di produzione" (production premium) that, during the '70s, lost completely, its original link to previous productive performance at the plant level.

\(^3\) See for example De Gregorio (1985), Della Rocca (1989), and Della Rocca-Ponzellini- Bigliotti et al. (1987).
is the appearance of the other kind of flexible compensation systems in which the wage is linked to company wide economic indicators of performance. The data available at this time are very preliminary and do not allow to reach any reliable conclusion as to which of the two kinds of systems is most prevalent. They certainly show, however, that company wide economic indicators are widely present.

Ponzellini (1987) describes the current evolution of gain sharing systems as characterized by a shift from incentives "based on physical indicators aimed at enhancing motivation" to incentives "based on economic indicators and aimed at increasing workers' participation". However she still considers this second kind of systems as an evolution of the previous one; she does not, go as far as to claim that they are a different phenomenon.

In the Introduction to this thesis evidence was reported from two recent incomplete surveys of the innovative contracts. Both these surveys indicate a wide presence of flexible compensation systems based on company wide economic indicators. The data collected by the IRES in Rome show that out of 239 innovative contracts, 88 are based on budget indicators, 23 are based on temporary lump sum bonuses, and 18 combine production and budget indicators. Similar evidence is offered by the data collected by Cossentino and Prosperetti (1989) on 60 contracts signed between 1984 and 1988. Out of these 60 contracts, 16 are characterized by economic indicators, 9 combine production indicators with economic indicators and 12 are based on lump sum bonuses.

Although these authors as well consider all the observed innovations as incentive devices, other information contained in their
paper points to market uncertainty as a possible important explanation for the choice of company wide economic indicators. Looking at the distribution of the type of gain sharing contracts by the type of ownership (public vs private), one finds that, while the percentage of private firms signing contracts with production indicators is 50%, the percentage grows to 56% for contracts that combine production and economic indicators, to 71% for contracts with pure economic indicators and finally to 92% for contracts based on lump sum bonuses. In other words, it seems that the proportion of private companies signing a particular kind of gain sharing contract is higher the lower the incentive component and the larger the economic flexibility of that specific contractual solution.

An interpretation of this result is offered by the consideration that private companies differ from public companies because of their greater sensitivity to the problems generated by market fluctuations. Private companies do not enjoy the possibility of seeing their losses covered by government finances, as on the contrary public companies do. On the other hand the latter are traditionally much more sensitive to the problem of inducing productivity among workers and hence much more likely to be interested in the introduction of incentive devices.

Looking at the effective incidence of the flexible component of the compensation package in companies signing gain sharing contracts, Cossentino and Prosperetti find numbers in the order of 3% and never higher than 10%. Such an incidence may seem almost irrelevant if

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*By effective incidence the authors mean the percentage of the total*
weighted in terms of its hypothesized capacity to create incentives. However, its importance increases if it is weighted in terms of the size of profits. As an example, looking at the cumulative data of the Mediobanca sample\(^5\), net profits average around 25% of the total base wage bill. A flexible component equal to 3% of that wage bill amounts to more than 12% of net profits.

None of the above evidence is in any way conclusive. It only shows that gain sharing contracts based on economic indicators are widely present in the recent contractual round. It also suggests that firms more sensitive to profit fluctuations are more likely to adopt them, and finally that the flexibility they provide might not be irrelevant if weighted in terms of profits.

**III.3 Flexible compensation as a risk sharing device: the insurgence of new conflicts**

The following comment by Mr. Michele Figurati, Personnel Manager at FIAT, on the lump sum bonus contract signed by his company in July 1988, seems to me particularly enlightening for an understanding of the role

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\(^5\) See Mediobanca (1988); Mediobanca is a financial intermediary that sponsors various research activities among which is the collection of financial data on a large sample of Italian companies. The computations presented in the text are derived from the cumulative data on 1206 of the 1640 companies in the sample, reported on p.238 of the quoted volume.
of uncertainty in explaining the flexible compensation phenomenon.

Talking about the position of the company at the bargaining table, Mr. Figurati acknowledges the "extremely good results" in term of profits and market share achieved by FIAT at that time; he adds, however, that despite those good results the firm was facing "a scenario that was very uncertain because of possible national and international evolutions". Given this situation FIAT had to find a strategy that could reconcile the following goals: "do not burden the firm with a large and permanent increase in labor costs given the highly uncertain situation; give a positive answer to workers' expectations in order not to worsen the industrial relations climate; keep in mind the good health condition of the company". The proposed solution is the "payment of a lump sum bonus to workers, such that, without commitment for the future, the good present company results could match workers' expectations of wage increases." 6

According to the FIAT manager, this compensation innovation is not motivated by the need to raise productivity or workers' motivation, objective that the company had already achieved during the process of internal restructuring in the early '80s. After years characterized by the absence of wage increases the firm had to satisfy workers'

7 Mr. Figurati observes, in fact, that the July 1988 contract "is the first after the long phase of internal restructuring, thanks to which strong improvements in term of productivity and efficiency have been achieved. In those years the company had developed a personnel strategy based on a more direct relationship with each individual worker and aimed at increasing workers' participation and their understanding of the firm's goals."

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expectations nourished by the outstanding economic performance of the firm. However, although in the past such a situation would have led to more traditional wage increases, maybe smaller in size but perceived by everybody as permanent, in this case the firm prefers to pay a large bonus without commitments about future compensation levels that ex post might turn out to be incompatible with profitability. In fact, the company commits itself to pay in the following year only 50% of the initial bonus and to discuss at that time an explicit way to link wage increases to company wide performance.

Keeping faith to this commitment, the July 1989 contract at FIAT establishes a new component of the compensation package that is explicitly linked to a highly sophisticated indicator of company performance. Although this second contract has been interpreted by commentators as showing the real intent of FIAT to create workers' incentives, this interpretation is in my opinion not convincing. It is hard for me to believe that any of the more than 200,000 workers employed by FIAT could be made to work harder by the fact that a relatively small part of her/his compensation is determined by a weighted average of the yearly changes of the following ratios: revenues / n. of workers; revenues / working capital; assets / working capital; expenses for warranties / revenues. From the firm's point of view, however, total wage bill fluctuations generated by the behavior of this indicator may represent large labor cost savings for the company, obtained automatically without having to bargain again over wages.

Not surprisingly Mr. Maurizio Magnabosco, Manager of union relations for FIAT, says about this most recent contract: "We have
succeeded in establishing the principle that in a particularly favorable situation workers participate in positive results, but in case of a market recession or in case of a the company’s crisis, a part of the compensation is reduced automatically. In other words, and this is the most interesting aspect of this contract, we have agreed that the economic situation characterizing a firm should not imply any commitment and any irreversibility of the future path of wage growth."\(^8\)

In order to describe under what kind of conditions the introduction of a compensation system with these characteristics might be feasible and might generate gains for the firm it is convenient to look at a simple model.

Consider a firm whose revenues \( R \) are determined, in each period, according to the following probability distribution:

\[
1) \quad R = \begin{cases} 
    m + \sigma & \text{with probability } p \quad \text{if } p > \frac{1}{2} \text{ and } m, \sigma > 0 \\
    m - \sigma & \text{with probability } (1-p) 
\end{cases}
\]

This assumption implies that there are two possible market situations, of which the most favorable has a higher probability of occurring.

Expected revenues are then

2) \( E(R) = m + \sigma(2p-1) \)

and since \( p > \frac{1}{2} \) they grow or decrease with \( \sigma \).

An increase in uncertainty is defined in this framework as an increase in the value of \( \sigma \); when \( \sigma \) becomes larger the amplitude of fluctuations across the two states widen. In other words the good state

becomes better but the bad state becomes worse. The assumption that $p > 1/2$ further restricts the consideration of uncertainty to the case of increases in the risk of the distribution compensated by higher values of its mean. These assumptions, although very restrictive, help to characterize a situation like the one faced by FIAT and described in the statements of its two managers quoted above: the situation of a company that is enjoying a period of increasing profitability combined with growing perceived uncertainty about the future.

Let's now consider for simplicity a single period and let's suppose that the wage contracted for that period by the work force and the firm is fixed and independent of the state of nature. Again for simplicity, let's assume that this fixed wage is

3) $W = m$

Leaving aside other factors of production, gross profits in the two states are

4) $U = \begin{cases} m + \sigma - W = \sigma & \text{with probability } p \\ m - \sigma - W = -\sigma & \text{with probability } (1-p) \end{cases}$

The objective function of the firm is assumed to be a concave transformation of gross profits. More precisely it is assumed to be concave in the size of losses. This is either because of risk aversion or because of the existence of additional costs that the firm has to face during downturns; for example, costs determined by worse conditions in the access to capital markets or by the need to forego otherwise profitable investment opportunities that in the good state would have been internally financed at an opportunity cost smaller than the
borrowing interest rate. Let's assume that this cost (or risk aversion) component is quadratic in the size of the gross profit losses. The objective function of the firm is then given by net profits $Y$ equal to

$$Y = \begin{cases} \sigma & \text{with probability } p \\ -\sigma - \delta \sigma^2 & \text{with probability } (1-p) \end{cases}$$

and the expected net profits are

$$E(Y) = \sigma(2p-1) - \delta \sigma^2 (1-p)$$

When $\sigma$ increases, expected net profits are initially positive and increasing, then positive and decreasing and finally negative - see the curve $E(Y)$ in Figure (a); this is because when fluctuations become larger, the expected cost of bad state realizations increases more than gross expected profits. In formal terms,

$$\frac{dE(Y)}{d\sigma} = (2p-1) - 2\delta \sigma (1-p) > 0 \quad \text{if} \quad \sigma < \frac{2p-1}{2\delta (1-p)} = \sigma_a$$

and

$$E(Y) > 0 \quad \text{if} \quad \sigma < \frac{2p-1}{\delta (1-p)} = \sigma_b$$

Hence, if fluctuations widen, unless the probability of a bad state $p$ is sufficiently high or the cost sensitivity parameter $\delta$ is sufficiently low, net expected profits decrease until they become negative. On the other hand, changes in $\sigma$ have no effect on wages since workers are granted a compensation package $m$ independent of market revenues.

Let's now suppose that the firm believes that $\sigma$ will grow above the level defined by (8), or that it will become high enough to reduce the level of expected net profits $Y$ below what was expected so far. In such a situation, by linking the wage to gross profits the firm is able to
Fig. a: FIRM'S OBJECTIVE FUNCTION

Fig. b: WORKERS' OBJECTIVE FUNCTION
share with the workers the risk generated by wider fluctuations of revenues. At a higher level of uncertainty this strategy may yield larger net profits than could have been expected under the old wage system. This is true even if workers are offered an expected wage higher than the one paid with certainty under the old system.

Consider for example the following alternative pay system in which workers receive on top of $m$ also a share $\gamma$ of the firm's gross profits:

$$ W^P = \begin{cases} m + \gamma \sigma & \text{with probability } p \\ m - \gamma \sigma & \text{with probability } (1 - p) \end{cases} $$

Hence workers participate in both gains and losses and their expected total compensation package is equal to

$$ E(W^P) = m + \gamma \sigma (2p - 1) $$

Under this compensation regime, the firm's net profits in the two states are

$$ Y^P = \begin{cases} (1 - \gamma) \sigma & \text{with probability } p \\ - (1 - \gamma) \sigma - \delta [(1 - \gamma) \sigma]^2 & \text{with probability } (1 - p) \end{cases} $$

and expected net profits are

$$ E(Y^P) = (1 - \gamma) \sigma (2p - 1) - \delta [(1 - \gamma) \sigma]^2 (1 - p) $$

It is now possible to evaluate the advantages and disadvantages for the firm and the workers brought by the introduction of the new pay system. Starting with the firm, the effect on expected net profits depends on the anticipated value of $\sigma$. The expected gain is given by the difference between (12) and (6) and it is equal to:
13) \[ E(Y^p) - E(Y) = -\gamma \sigma (2p-1) + \delta (1-p) \sigma^2 [1 - (1-\gamma)^2] \]

where the first term on the right hand side of (13) is the loss represented by the expected share of net profits that has to be paid to workers, while the second term is the gain represented by the expected reduction of cost suffered when the bad state of nature occurs. The difference is positive when

14) \[ \sigma > \frac{(2p-1)}{\delta (1-p)(2-\gamma)} = \sigma_c \]

As Figure (a) shows, given the share \( \gamma \) and the other parameters \( p \) and \( \delta \), if the firm believes that \( \sigma \) is going to increase above the level \( \sigma_c \), the introduction of the sharing system yields a level of net expected profits higher than the one that would have been expected under the traditional wage system at the same larger level of uncertainty. Furthermore, while under the old system values of \( \sigma \) above \( \sigma_b \) imply the expectation of losses, under the new system losses are expected only for values of \( \sigma \) larger than \( \sigma_d \), where \( \sigma_d \) is the value at which \( E(Y^p) = 0 \):

15) \[ \sigma_d = \frac{2p-1}{(1-\gamma)\delta (1-p)} > \sigma_b \]

The expectation of higher net profits under the new compensation system is due to the fact that when \( \sigma \) is sufficiently high the expected saving on the cost of losses is larger than the expected share of profits to be paid to workers.

As far as workers are concerned, the transition to the new sharing system increases expected total compensation. This result is evident from the comparison of (9) and (3). However, if on the one hand the firm suffers an additional cost when gross profits are negative, on the other
hand, workers are also likely to suffer a similar cost when their compensation package decreases below what was customarily paid to them with certainty under the old regime. If we assume also for workers a quadratic cost function, the net income $M^p$ received by workers in the two states is given by

$$16) \quad M^p = \begin{cases} \quad m + \gamma \sigma & \text{with probability } \quad p \\ \quad m - \gamma \sigma - \mu[\gamma \sigma]^2 & \text{with probability } \quad (1-p) \end{cases}$$

and the expected net income is

$$17) \quad E(M^p) = m + \gamma \sigma (2p-1) - \mu[\gamma \sigma]^2 (1-p)$$

If workers' net income is considered, it is no longer necessarily true that the sharing system is preferred by workers; in fact it turns out to be preferred only if fluctuations are not too large. More precisely:

$$18) \quad E(M^p) > m \quad \text{if} \quad \sigma < \frac{(2p-1)}{\gamma \mu(1-p)} = \sigma_f$$

Hence, the transition to the new pay system may open a conflict between the workers and the firm, in relation to the amplitude of expected revenue fluctuations. The comparison between (14) and (18) shows, in fact, that the introduction of the risk sharing system is favorable to workers only if fluctuations are not too large, while on the contrary it is favorable to the firm when fluctuations are sufficiently large. Figure (b) describes two possible expected net income curves for workers, as functions of $\sigma$: the one marked with the subscript 2 corresponds to a smaller cost parameter $\mu$. If this is the relevant curve, the value $\sigma_{f2}$ above which workers suffer expected losses with respect to the traditional system is higher than the level $\sigma_c$ above
which the transition to the risk sharing system is convenient to the firm; hence there exists a range of values of $\sigma$ for which both parties want to shift to the new pay system. On the contrary, in the case denoted by subscript 1, the cost of income losses is so high for workers that the risk sharing system is favorable to them only when fluctuations are very small. Hence, in this second case, for all values of $\sigma$ there is a conflict of interest between the two parties.

The eventual?ility of a conflict between the workers and the firm becomes even more relevant if we abandon the hypothesis that the parameter $\sigma$ is exogenous and we assume that it may be determined by managerial decisions. Suppose, for example, that the firm faces different investment projects ranked according to the correspondent parameter $\sigma$, that indicates both their riskiness and their expected return. Projects with higher expected return are also characterized by higher risk.

If the firm maximizes net expected profits under a traditional wage system, it will choose a project such that, given (6), the corresponding $\sigma$ is equal to

$$19) \quad \sigma^* = \frac{2p - 1}{2\delta(1-p)}$$

On the contrary, under a profit sharing system, the optimal value of $\sigma$ is given by the maximization of (12):

$$20) \quad \sigma^* = \frac{2p - 1}{(1-\gamma)2\delta(1-p)} > \sigma^*$$

The comparison between (20) and (19), also illustrated in Figure (a), shows that in a profit and risk sharing system the firm has an incentive to choose projects that imply a larger return but also a larger risk.
On the other side, workers' participation in profits and risk obviously makes them more sensitive to the characteristics of the projects chosen by the firm, while in the traditional system the riskiness and expected return of projects are totally irrelevant for the work force payoff.

If workers were allowed to choose the project that maximizes their net expected income, given (17), their choice would be

\[ \sigma_g = \frac{2p-1}{\gamma^2 \mu (1-p)} \]

The comparison between (21) and (20) shows that

\[ \sigma_0 > \sigma_g \quad \text{if} \quad \gamma \mu > (1-\gamma) \delta \]

In other words, the higher are the workers' share and the cost sensitivity parameter \( \mu \), the lower is the riskiness of the project chosen by workers. It is however important to highlight the fact that if on the one hand the transition to a sharing system favors the adoption of riskier projects, on the other hand it does not imply that the higher riskiness is necessarily disliked by the workers and liked by the firm. For example, the two hypothetical workers' net income curves represented in Figure (b) imply on the workers' side the choice of optimal values of \( \sigma \) that are respectively smaller and larger than the optimal value \( \sigma_0 \) that would be chosen by the firm.

The conclusions that can be drawn from the above model can be summarized as follows.

a) In a situation of increasing uncertainty, characterized by a sufficient widening of the amplitude of expected revenue fluctuations, the firm gains with the transition from a fixed ex
ante wage systems to a profit sharing system. Hence, there are reasons to believe that a more uncertain horizon might make a firm willing to shift to a profit sharing system.

b) Net profits may be expected to increase also if the new system offers to workers an expected total compensation package that is higher than the one customarily granted with certainty under the old fixed wage system. Despite the higher expected wage, expected profits may be higher because the firm, by sharing not only profits but also losses, saves on the additional cost of losses when the bad state occur.

c) However, although the transition to profit sharing may allow to increase both expected net profits and expected compensation, the transition is not always necessarily preferred by workers. This is because workers suffer an additional cost when their compensation falls below the level customarily paid with certainty under the fixed wage system. If this cost is taken into account the net expected income of workers becomes higher under the sharing system only if fluctuations remain sufficiently small.

d) Hence, this opens the possibility of a divergence of interest between the work force and the firm concerning the adoption of the new pay system. The former's payoff is in fact positive only if fluctuations are not too large, while the latter gains only when fluctuations are sufficiently large. A convergence of interests is, however, possible under certain parameter values.

e) If, finally, we assume that uncertainty is not totally exogenous but, on the contrary, depends on managerial decisions concerning
investment projects that have expected returns increasing with risk, the possibility of a conflict between the workers and the firm becomes more significant. First of all, the firm has an incentive to choose projects that have higher returns but also higher risk, because part of the risk is borne by the work force. Furthermore, workers are compelled to interfere in the investment decisions of the firm because the riskiness and the profitability of the projects that are chosen affect their compensation. It is, however, not true, as in a first approximation one might think, that workers necessarily prefer projects that are less risky than those preferred by the firm. This, in fact, is true only if their share of profits is sufficiently high and/or the cost of losses for workers is sufficiently large with respect to the analogous cost suffered by the firm.

III.4 Long term implications of risk sharing flexible compensation contracts

The previous section has argued why a situation of greater uncertainty might be relevant in order to explain a large part of the gain sharing contracts recently observed in Italy. The next step, of course, would be to test econometrically if proxies for the uncertainty perceived by firms are in fact significant predictors of the decision to introduce a gain sharing program based on company wide indicators of performance. Unfortunately, data are yet not available in Italy to carry out such an empirical analysis. The only evidence that currently supports the view suggested in the previous section is the qualitative,
but not less convincing, one provided by statements and interviews with employers who described events like the increasing opening of the Italian economy toward foreign markets, the process of European unification, and the free market evolution of eastern economies, as factors that certainly created profitable opportunities but increased uncertainty as well.

Waiting for the availability of data that, for example, allows one to test whether firms more sensitive to those kinds of events are the ones more likely to introduce the mentioned innovations, in this final section I would like to consider what might be the industrial relations implications of contracts based on company wide indicators of performance. These potential consequences are completely disregarded by those who view the Italian gain sharing phenomenon just as a phenomenon of effort inducement. The relevance of the implications that the alternative view foreshadows suggest that the failure to understand the risk sharing nature of most of the recent gain sharing contracts may be misleading in an important way.

Issues like productivity, working pace, organization of the shop floor activity and so on, have always been part of a confrontation between workers and firms at the bargaining table and more informally at the shop floor level. Given this tradition, the diffusion of gain sharing programs based on production indicators does not open any new source of conflict within the firm beyond those that have always been there. On the contrary, issues like the choice of investment projects, pricing policies, product lines and so on, are all issues over which very rarely firms had to face a confrontation with union
representatives. Traditionally the Italian labor movement has left to the employer these kinds of choices, while focusing its activity on wages, employment and productivity at the shop floor\textsuperscript{9}.

The model discussed in the previous section shows that, when a profit sharing contract is introduced, the choice of limiting the union activity along the lines of the Italian tradition might be very costly for workers. This because, under the new regime, in order to control wage determination one has to control what affects profit fluctuations. It is then reasonable to expect that a union wanting to control wages might sooner or later ask to take part in those managerial decision affecting profits and risk. If the gain sharing contracts appearing in Italy are not just incentive devices but in part respond to a risk sharing need of firms, their increasing diffusion may sooner or later force Italian unions to change their traditional strategy, to learn how to discuss managerial decisions and to ask for the possibility to do it\textsuperscript{10}.

This is a possibility that was already highlighted by Mr Bruno

\textsuperscript{9} This has not been the traditional choice of other European labor movements, as for example the German one, that has long favored codetermination agreements.

\textsuperscript{10} The, unfortunately, fragmentary information from newspaper articles on which I can report, suggests that something like this might be happening at Olivetti, where the bad recent company performance, after the introduction of a company wide gain sharing program, has been attributed by unions to strategic managerial mistakes, among which is the acquisition of an unhealthy German company; this choice, made by the firm before the new contract was signed, did not seem to raise union objections at that time, and only now seems to have become an issue. The information suggesting these considerations needs however to be carefully checked with interviews with firm an union leaders.
Visentini\textsuperscript{11} in a newspaper comment while the bargaining for the July 1988 FIAT contract was going on. "If the compensation package depends in an important way on firms profitability, it could become impossible to stop a request (that in principle could be made on the basis of the Art. 46 of the Constitution) for workers participation in managerial decisions. ... Every worker would have good reasons to ask why his wage should depend on decisions taken by incompetent managers and to ask that those managers be substituted with better ones. Furthermore, any managerial decision - the choice of new products, prices and so on - might become an object of daily bargaining."\textsuperscript{12}

This is considered by Mr. Visentini as extremely dangerous for the good functioning of the firms and the economy, but the reason for which these dangers should be real is far from obvious. If workers' participation occurred in appropriate institutionalized forms, maybe analogous to those concerning share holders, the existence of danger for the firm and for the economy would have to be demonstrated. In fact those same workers that are called to share firms' risks by a profit sharing contract are not prevented from buying common full rights shares in the market. However the consideration of these issues, and in particular of the dangers or the advantages of workers participation in managerial decisions is not the goal of this chapter. The goal here is just to examine whether the trend toward a diffusion of flexible compensation contracts based on company wide indicators of performance

\textsuperscript{11} Minister of Finances in several Italian Governments.
\textsuperscript{12} See Visentini (1988)
would foster a stronger demand for participation on the side of workers.

In fact, one could argue that there should be no more demand for such participation than the one that already exists. Independently of profit sharing, workers have already very good reasons to interfere in managerial choices, since layoffs affect workers' income and position much more heavily than profit fluctuations in a profit sharing system do. However, while in the present situation unions do in fact question managerial decisions in those extreme, and fortunately not frequent, situations in which layoffs occur, under a profit sharing system the pressure for questioning managerial decision would be more continuous, and in particular would occur also in situations far from critical. It could also be argued, on the basis of arguments like the one proposed by Martin Weitzman, that profit sharing should reduce the sources of conflict given its capacity to stabilize employment. However, a truly convincing empirical proof of the existence of these employment effects has yet to be produced\textsuperscript{13}, and, anyway, the reduction of employment risk would not affect the majority of workers who in most situations do not in fact risk losing their jobs.

Hence, in my opinion, the diffusion of flexible compensation systems is going in the long run to open a new source of more frequent confrontations between management and workers concerning a large set of decisions on which unions currently interfere only in critical situations. This is, however, a development unlikely to occur in the

\textsuperscript{13} See Weitzman (1984), Wadwhani and Wall (1988) and Kruse (1987)
near future mostly because Italian unions are not only traditionally far from favoring codetermination systems, but more importantly because they are very far from being technically prepared for such a challenge. The perception of this weakness of the unions is likely to have increased the desirability of these contracts to firms like FIAT that certainly would have otherwise less enthusiastically welcomed an innovation threatening managerial freedom.

The current position of unions is to strongly oppose flexible compensation contracts based on economic indicators of performance, although, as shown in Section 2, firms have often been able to impose their introduction. Unions are in principle willing to bargain over wage flexibility only if it is linked to production indicators of performance. This kind of shop floor indicators is in fact the only one on which unions are at the moment ready to bargain given that they have done it for a long time, although maybe in other forms.

By blindly opposing flexible systems based on company wide indicators of performance unions seem to only perceive the bad consequence of them, i.e. the risk of compensation fluctuations; a consequence that anyway they currently are not strong enough to avoid. On the other hand, unions do not seem to perceive what else is at stake: namely, the opportunity to create the conditions for a transformation of the Italian industrial relations system that certainly would increase the role of unions and allow for a better representation of workers interest.
Conclusions

The focus in this chapter has been on the industrial relation implications of flexible compensation systems in Italy. It was argued that gain sharing systems based on technological indicators of performance evolve, in that country, from historical trends and do not represent a break point in those trends; on the contrary, systems based on company wide indicators do not evolve from the same trends and are instead adopted as risk sharing devices by firms facing more uncertainty about the future. It was further argued that the recent diffusion of profit sharing and lump sum bonus contracts might lead to a break point in Italian industrial relations trends. Far from increasing workers' identification in company goals, as the interpretation based on incentive would suggest, the diffusion of these contracts might create new sources of conflicts within the firms concerning those managerial decisions that affect the riskiness of investment projects. Important implications for the future of industrial relations, involving the possibility of an evolution toward workers' participation in managerial decisions, are then open to discussion.
References

Cossentino, Franco, Luigi Prosperetti, "La diffusione di accordi di gainsharing in Italia: tendenze, problemi, prospettive" Mimeo, 1989


De Gregorio, Roberto, "Incentivi monetari e sviluppo della produttivita'", in Sviluppo & organizzazione, n. 87, January-February 1985

Figurati, Michele, "Retribuzione flessibile: l'accordo integrativo FIAT", in Rassegna di statistiche del lavoro, n. 1, January-March 1989


Magnabosco, Maurizio, "Accordo FIAT: atto secondo", in Diritto & e Pratica del Lavoro, n.30, 1989


Ponzellini, Anna, "La retribuzione per risultati nella contrattazione aziendale", in Studi organizzativi, n. 3-4, July-December 1987

Visentini, Bruno, "I profitti di Agnelli e quelli di Cipputi", in La Repubblica, July 8, 1988

Wadwhani, Sushil, David Wall, "The effects of profit sharing on employment, wages, stock returns and productivity. Evidence from U.K. micro data.", Centre for Labor Economics, L.S.E., June 1988